MEDICAL

Dissertations

DELIVERED

AT THE ANNUAL MEETINGS

OF THE

MASSACHUSETTS MEDICAL SOCIETY.

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MEDICAL COMMUNICATIONS.

ARTICLE I.

A

DISSERTATION

ON PNEUMONIA.

By His Excellency JOHN BROOKS, M.D.

Fellow of the Massachusetts Medical Society, of the American Society of Arts and Sciences, &c. &c. &c.

Read at the annual meeting, June 1st, 1808.

The subject I have selected for consideration is that description of Fever denominated Inflammatory. I shall limit my remarks more especially to Pneumonia.

Fever in various forms is one of the most frequent and destructive diseases, incident to the citizens of our country. According to some of the latest bills of mortality indeed, which have been published, phthisis pulmonalis commits the greatest havock in our populous cities. But if many of these cases originated, as I imagine they might have done, in neglected, or mal-treated pulmonic inflammation, they may with some propriety be referred to this disease, and the plurality in those statements be thus changed. The ravages of fever, however, there is reason

to believe, are less ascribable to the intrinsic nature of that class of diseases, than to contingent and remediable causes. But human life is short, diseases are various and complicated, remedies infinitely numerous and equivocal, and the experience and skill of most men are doomed, like themselves, to oblivion. Hence the utility of medical institutions, through the medium of which, the discoveries of individuals become the property of the public, and, conversely, the aggregate mass of facts and improvements is enjoyed by each individual as his own.

The remote and proximate causes of fever have been subjects of endless research, conjecture and discussion. Scarcely any writer on fever can be found, who has not attempted to establish his own favourite theory. Even Sydenham, who seemed to reprobate the practice, could scarcely inscribe a page of historical facts, without the aid of an explanatory hypothesis. But not to enter upon a discussion of this subject, I would just observe, that one of the most obvious causes of fever seems to be connected with, or dependent upon temperature; but not of any absolute or specific grade. Cold, as a debilitating power upon the human organization, is relative to the state of the system as it respects predisposition, and relative to preceding temperature. A man under the influence of indirect debility from intemperance, or the stimulus of high temperature; or of direct debility from

excessive watching or fatigue, is more susceptible of morbid impression from cold, than one whose excitability has been maintained by temperate living, moderate temperature and gentle exercise. Soldiers, exposed in autumn to the cold air of their tents by night, and to the heat of the sun by day, are prone to severe coughs and colds. To them the vicissitudes of day and night are greater, and more abrupt, than to those who inhabit houses. Individuals, who pass from the high latitudes to a vertical sun and a rarified atmosphere, most dreadfully suffer from the change: while the stationary inhabitants of the torrid zone shall enjoy health and comparative vigour. Persons accustomed to the air of a warm room and the contact of thick clothing, shrink with horror under the debilitating effects of a cold atmosphere, and light apparel. While, on the contrary, men of robust habits, enured to the endurance of cold, and slender garments, soon sicken on being confined to hot apartments.

Do these considerations afford us a clue to the remote cause of fever? The transition, then, from the remote to the proximate is easy. Professional observation and the sensations of the sick unite in impressing upon us the idea of an imparity of vascular action, and a lost balance of the vascular contents. The vessels on the surface of the body suffer torpor and inanition. The heart and the great trunks of the blood-vessels become distended, surcharged and op-

pressed; and the lungs, the stomach, the liver and most of the other viscera, suffer repletion and enlargement. A plethoric and gorged state of these organs becomes a stimulus to inordinate action; inflammation occurs; and fever, of one denomination or another, modified by accidental or constitutional predisposition, ensues, as one set of organs or another, shall be in a condition least to resist the pressure of redúndance. The brain meanwhile is not exempt from suffering. This viscus, though incapable of intumescence, must suffer the consequences of pressure from the derangement of equilibrium in the circulations, from a preternatural determination of blood to its vessels, or from the remora of an accumulated mass in the vena cava to its refluent blood, as well as from its sympathy with other suffering organs. Do the phenomena of fever, and the effects of remedies, serve to support and illustrate these ideas of the causes of this affection? I am aware that many others have been assigned as the proximate causes of fever; among which are moisture, the matter of vegetable nutrition, and the gaseous productions of animal and vegetable putrefaction.

Happily for us, however, if the causes of disease have not been specifically detected and demonstrated, yet many causes of error have been exposed, and many of the laws of the animal economy are brought within our cognizance. Great progress has been made in discriminating

the pathognomonics of diseases; the indications of cure have been ascertained, and the appropriate remedies discovered. As it respects the subject under consideration, whatever theoretical notions may be entertained by different individuals, all agree that the contemporaneous occurrence of certain phenomena constitues that state of disease denominated fever.

Every disease is characterized by a combination of distinctive features. If various modifications of morbid action sometimes occur, they are referable to a difference in the force or activity of the cause, to occasional susceptibility of diseased action, or idiosyncrasy of habit which art can never develope. It is the part of the physician to distinguish the essential characteristics of disease from anomalous and contingent concomitants, and assign to each its respective degree of importance.

The best explication of fever, general definitions being either illusive or imperfect, is its history; and the best substitute for this, is a specific enumeration of its symptoms. But on this occasion it would be superfluous to recite in detail the great variety of pyrexial symptoms. Lassitude, loss of appetite, rigours, or slight sense of cold, succeeded by heat, prostration or reduction of muscular strength, thirst, head-ach, and interrupted secretions and excretions, are among the most prominent. But to designate thoracic inflammation other signs are superadded. Pain

in some part of the thorax, from the most acute and pungent, to that which is obtuse and scarcely perceptible—sometimes fixed, at others vagrant. A sense of fulness at the chest, difficult respiration, cough with and sometimes without expectoration; the matter expectorated consisting usually of a viscid glairy matter, and marked or intermixed with blood. Palpitation of the heart, anxiety at the præcordia, sense of suffocation upon a change of position, and lipothymia in any other than a supine posture. The four last mentioned symptoms I consider as resulting from an inflammation of the heart or pericardium. Under different grades and modifications of the general diagnostics, the pulse varies from full, hard and frequent, to slow, obscure and small.

In the high grades of pneumonic inflammation, few physicians will hesitate as to the means of relief. Excessive excitement in vital organs demands the most prompt and powerful remedies. Delay is often ruinous. In addition to the first impression of excitement, the parts affected speedily acquire a habit of morbid action; a destruction or change of organic structure ensues, and the disease sets at defiance every effort of art. To obviate this fatal result, venesection is the leading, the paramount remedy. But to insure its salutary and decisive effects, its employment should be seasonable and copious.

Pulmonary inflammation, however, is not always distinctly characterised. Its advances are frequently insidious. Respiration may be embarrassed, the pain, heat and thirst may be considerable, but the pulse small, oppressed and rapid, somewhat resembling the pulse in typhus. But this semblance of typhoid irritation may conceal an excess of excitement; and I am apprehensive that this oppressed state of arterial action, conceived to occur from defect of stimulus, has proved a fruitful and fatal source of error. But venesection in such cases is indispensable. The almost instantaneous emergence of the pulse, and liberation of the action of the lungs, solves the ambiguity of arterial action. Phlebotomy as a remedy in pneumonia, is one of the most ancient and incontestable, borne on the records of medical history. Physicians, in former times most eminent for talents, learning and experience, have given the fullest testimony of its efficacy; and with their attestations the experience of the present day is in perfect unison. To determine the frequency of repeating the operation of bloodletting, must depend on the circumstances of each particular case. The exigence of the case must decide the time when the lancet must be used, and the age, constitution and habits of the patient will have an influence in determining the amount of blood to be taken. But so long as the distressing symptoms continue, and the sthenic action of the heart and arteries is sup-

ported, so long should venesection at proper intervals be repeated. For myself I can aver, that I have never known an instance of pneumonia proving fatal, in which timely and duly repeated bleeding was resorted to; that I have never seen an instance in which depleting by the lancet became injurious; but that on the other hand, I have witnessed some unhappy instances in which its omission, or partial employment, was followed with mortal effects.

All sthenic inflammatory affections of the thorax are accompanied with congestion, increased secretion and extravasation. Increased organic action implies an increase of sensibility, an accelerated impetus to the fluids, and an increased, as well as an enlarged vascularity. The blood vessels being enlarged, or admission yielded to a greater volume of blood, the red globules having access to, are impacted in the serous capillary vessels, and become a new stimulus, and the cause of a new train of action. Such is the state of the vascular system. While in the cellular texture, on the surfaces of the bronchial ramifications and air vesicles, and of the cavities of the thorax, and sometimes of the pericardium, quantities of lymph and serum are deposited and accumulated beyond the power of absorption by the oppressed and torpid lymphatics. If the symptoms of pneumonia do not warrant this rationale of congestion, secretion and extravasation, the evidence of facts will be deemed

conclusive. The dissections of Morgagni abound with instruction on this point. In his inestimable work on "*The seats and causes of Diseases,*" numerous dissections are given, in his very minute and detailed form, of cases, in which *the substance of the lungs was enlarged, inflamed, hard, ulcerated, resembling liver and boiled liver; in which the air vesicles were stuffed with a white frothy matter, with matter like pus, with purulent matter, and with bloody matter;* in which *there were adhesions of the lungs and pleura,* of the *lungs and pericardium,* and of the pericardium and the heart; in which *serum, bloody serum, and purulent serum, were found in the cavities of the thorax and pericardium.* Such are a few only of the appearances after death in consequence of pulmonary inflammation mentioned by Morgagni. My own professional circle has furnished me with repeated opportunities of inspecting subjects who had died of a similar affection, and in which the morbid appearances resembled those recorded by this writer. I examined a subject a few days since, who, after having suffered in the course of five years, repeated attacks of pneumonia, died of phthisis, in which there was a greater enlargement of the cellular substance between the sternum, ribs and intercostal muscles, on the one part, and the pleura, on the other, than I had ever before observed; or than is mentioned in the above named work—the cellular intumescence being the thickness of a man's finger.

The anterior portion of the pericardium adhered firmly to the pleura, and another portion of it was attached to the lungs. The lungs likewise adhered to the pleura through the whole extent of both lobes. Besides which the air vesicles of the lungs were almost obliterated from an enlargment of the parenchymatous structure. The lungs were of a very dark liver colour, and their hardness was similar to that of an indurated gland. The cavities of the thorax and pericardium contained a pound and an half of serum.

Such are some of the evidences of congestion, increased secretion, and extravasation. They prove the derangement of organic structure by inflammation, and evince the necessity of copious bleeding in the early stage of disease, not only to extinguish inflammation, but as the only prophylactic of its terrible consequences. I have no conception of general plethora, as a cause of pneumonia. But that a certain degree of fulness of the blood-vessels, or a certain condition of these vessels connected with, or depending upon, fulness, contributes to the support of local inflammatory action, there can exist no reasonable doubt. It must have occurred to the observation of every experienced physician, that the reduction of violent excitement is effected most efficaciously, and with greater celerity, by copious bloodletting, than by any other means. The exigencies of high sthenic diathesis require an immediate subduction of stimulus. Reme-

dies, the operation of which is gradual and circuitous, are inadequate to the subversion of disease violent in its onset and rapid in its progress. The arteries, in a manner the most direct and summary, must be exonerated of their plenitude. When this object is effected, and the further augmentation of parts is arrested, there being no further demand for the lancet, measures should be adopted for dissipating extravasation, and reducing the enlargment of organic structure. To enable us to fulfil these intentions, nature has been liberal in her provisions.

In the animal economy the absorbent system is an important and efficient constituent. This system is endued with singular powers, and energy of action, although the laws by which its functions are regulated, have eluded the observation of physiology. Besides being the great medium of nutrition, health and life are dependent on its co-operation with the vascular and nervous powers. Although there be something inexplicable in the absorption, we must consider it as a provision of nature, among other purposes, for the removal, not only of extravasated fluids, but of preternatural and diseased solids. Nor is this provision more wonderful than that the whole animal organization, in a state of soundness, should be subject to the laws of perpetual waste and regeneration. Whether, during the progress of inflammation, the accumulation of fluids in certain cavities, and the increase of vascularity,

be owing to a suspended or diminished action of the lymphatics, or to an action of the arteries and their secretory branches transcending that of the lymphatics, or partly to each of these causes, we may expect that when the stimulus of disease shall have been withdrawn, and sthenic action subdued, the lymphatics will resume their customary course of action ; perhaps with increased vigour, proportionate to their late torpitude and inaction. This very cursory view of the absorbent system, leads us to appreciate its importance in the animal economy, and to direct our attention to its powers in the cure of diseases.

I now proceed to notice some other remedies in the therapeutical management of pneumonia, in addition to venesection. I would, however, previously remark, that the demand for other prescriptions will depend on the use that has been previously made of the lancet. If it has been seasonable and liberal, there can be but slight congestion and extravastion, and consequently little difficulty of breathing, slight cough, and inconsiderable expectoration. But we sometimes meet pneumonia in its most menacing forms, when all the resources of art will be in requisition, and other remedies co-operative with venesection, though less subductive of morbid stimulus, must be employed.

Cathartics, by depleting the intestines, lessen pressure upon the diseased organs of the thorax. They diminish arterial action, and pro-

mote lymphatic absorption. Preceded by venesection, they act with greater facility and effect. The well known powers of mercury to lessen visceral inflammation recommend the sub-muriate of this metal, not only as an alterative, but as a purgative. I commonly prescribe it from six to twelve grains soon after bleeding, with purified nitre, the super-tartrite of potass, or the acetated vegetable alkali, to be succeeded in two or three hours by an ounce of the sulphate of soda and manna, or senna and manna, the castor oil, or any other gentle cathartic. The sub-muriate of mercury is not a drastic purge, but it is, in the form mentioned, commonly certain. Besides, this medicine promotes the secretions and absorption. Hence its use as alterative. To these remedies, applicable to the inflammatory state of fever, must be added rigid abstinence from stimulant food and drinks, a free use of mucilaginous and sub-acid diluents, unless when acids provoke coughing, and an occasional use of oleaginous preparations.

Vesication is another important remedy in pneumonia. Medical opinions on this article have been various, some having advocated, and others opposed, its use. The visible effects of vesication are unquestionably produced by the stimulant property of cantharides. But stimuli applied near the seat of pain and disease in some other inflammatory affections, or to a part of the surface sympathizing with the diseased part, tend to lessen and suspend the action of morbid stimu-

lus, and deplete those vessels which had been gorged with fluids by excessive action. I have not myself observed the stimulus of cantharides to communicate to the moving powers, generally, an increase of morbid excitement. On the contrary, the pulse has been rendered less frequent, the embarrassment in respiration, the pain and sense of fulness at the chest, have been sensibly relieved, and expectoration rendered more easy. "*The relief obtained by them in this way,*" as is observed by an author of our own country, "*more than balances their stimulus upon the whole system.*" It is, however, with blisterng, as with other secondary remedies, that its use may be precluded by plentiful bleeding. As soon as by this operation, the pulse is reduced, the pain abated, and the breathing rendered tolerably easy, (which I presume ought to be effected at the first visit, especially if the patient should reside at a distance from his physician), I am in the habit of directing free vesication as near the pained part as possible. Even if there be no fixed pain, but a general sense of fulness of the chest, or stricture, and difficulty of making a full inflation of the lungs, I order the vesicatory between the scapulæ, or upon the anterior part of the thorax. This is a point to which I pay the most scrupulous attention. In confirmation of my own sense of the utility of extensive vesication, it has rarely happened that the testimony of the patient has been wanting to the same result.

Besides the use of cantharides already mentioned, they are beneficial in another stage of the disease. When the excitability of the system has been diminished by disease and depletion, the action of the heart and arteries has become languid, and the vessels in the extremities are in a state of torpor aud debility, the stimulus of cantharides is highly useful, as rubefacients. I would, however, observe here, that the stimulus of horse-radish leaves, and sinapisms of mustard-seed, where the intention is to restore and support the vigour of the circulation, is preferable to that of cantharides. The stimulus of the two former is more gentle, but more permanent.

In almost every case where the advice of a physician has been seasonably invoked, and the remedies already recognized have been duly employed, the ardent state of disease will have terminated by the third or fifth day, and the patient be assuming the convalescent state. But it frequently happens that before any remedy is interposed, the disease has made considerable progress. In these cases no depletion, no evacuations, nor counter stimuli, can obviate cough and expectoration. After such evacuations, therefore, as the advanced state of the disease, and the impaired condition of the excitability will justify, it is of the utmost importance to encourage expectoration and absorption, and to determine the vascular action to the cutaneous surface. Expectoration being proportionate to the degree of mor-

bid excitement, and the secretions into the bronchial system, in many cases becomes difficult and laborious, and requires much management. A stimulant course becomes necessary. In adopting which we are not unfrequently obliged to govern ourselves by the peculiar antipathies of the patient. Among the class of expectorants, the most stimulant and efficacious are the squills, variously prepared, Rad. Seneg. Ipecacuanha in substance or tincture, and the decoction of Verbena and Bupleurum. When in an advanced stage of pneumonia the lungs are oppressed with mucus, sthenic action has subsided, and great debility induced, small draughts of cider, wine, or of ardent spirit duly diluted, have an admirable effect in promoting expectoration. With a view to the same intention, opium and its preparation may be prescribed with the most happy effects. Small doses of this medicine may be introduced immediately after the subduction of morbid stimulus, and repeated as the irritable state of the lungs may indicate, to great advantage. If the doses should be so large as eventually to produce debility by over excitement, it will prove injurious. In the stage of pneumonia now under consideration, the skin, in some cases, becomes dry and hot, the cough fruitless and constant, and the patient restless. Under these circumstances, a pill containing from one to two grains of opium, and an equal quantity of sub. mur. of Merc. and Ipecac. given at six, and

another of the same kind, if necessary, repeated at 9 o'clock insure a moist and temperate skin, refreshing sleep, an abatement of cough, and the next morning, a free expectoration.

During the exhibition of this series of prescriptions, and till cough and expectoration have terminated, I have derived great satisfaction from the use of digitalis. Waving a discussion of the question whether the digitalis be stimulant or sedative, I shall merely state that for several years past I have been in the habit of using this powerful vegetable. Apprehensive that a medicine of such activity could never be given with impunity in a disease to which it was ill-adapted, and being destitute of the requisite data to warrant its prescription, I have hitherto declined its exhibition in the inflammatory period of pneumonia. When this stage had passed I have used it both for children and for adults; and have found it highly efficacious in diminishing the frequency of pulse, in abating cough and lessening expectoration. In numerous, and in some very impressive instances, where the cough was urgent, the pulse rapid, heat considerable, with morning rigours, nocturnal sweats, copious expectoration of purulent or puriform matter, and indeed every symptom of incipient phthisis, the digitalis, given and persevered in, twice or thrice in a day, in doses as large as the stomach and head of the patient would bear, has happily

relieved these complaints, and perfectly reinstated the patient's health. As on these occasions I have seldom been able to satisfy myself that any of the secretions or excretions were increased, I have ascribed its effects to its action on the lymphatics, and a disposition of the absorbed matter at present inexplicable. Does a chemical change take place in the matter constituting congestion previously to its absorption by the lymphatics? And if so, may not this matter be thus reconverted to nutriment for the general system, to supply the waste of previous disease? On this article, I would only subjoin, that in cases where the administration of digitalis has been most decidedly efficacious, an impaired appetite, loathing of food, nausea and giddiness, have either separately or jointly occurred.

PERHAPS there is no disease after which the appetite more speedily returns than pneumonia. A crisis in this fever is generally distinctly marked. After which there is less occasion for medicine, than for caution and prudence. In the state of incipient convalescence it is particularly necessary that the stimulus of food should be adapted to the existing state of excitability. Errors in this particular are the common source of relapses.

I HAVE hitherto been silent as to emetics. They have some claim to consideration as a collateral, though not an appropriate remedy in the cure of pneumonia. When the stomach is

surcharged with acrid matter, whether it be bile, or the vitiated product of undigested aliment, and vomiting should supervene, an emetic of Ipecacuanha may be highly proper. It will not only relieve the patient of much present distress, but obviate hiccup, which might otherwise be pernicious and alarming. Within the last month, I was called to two female patients, who had, two days previously to my visiting them, been seized with pneumonia. Each of them had taken a powerful antimonial emetic, without effect. I bled both freely, and in twenty-four hours they recovered. In pneumonia, during the first onset, emetics of the antimonial kind exhaust the vital energy, without impairing the force of morbid action.

I CANNOT feel satisfied to close this sketch without reiterating my ideas of the necessity of a liberal employment of the lancet in diseases of sthenic diathesis, not only at their first attack, but so long as this diathesis shall continue. Indeed, in its powers of conquering violent pneumonic inflammation at its commencement, of obviating congestion, adhesions and ulceration, the lancet defies competition and admits of no substitute.

THE END.

ARTICLE II.

A

DISSERTATION

ON

CYNANCHE TRACHEALIS, OR CROUP.

By ABRAHAM HASKELL, M.D. M.M.S.S.

Read at the annual meeting, June 1st, 1812.

OF CYNANCHE TRACHEALIS, OR CROUP.

The tracheal quinsy is selected for the subject of the following dissertation, not because it is a new form of disease, nor because much has not been written on the subject: but partly because its occurrence in certain parts of the country is so rare, that some physicians can scarcely say, they have ever seen a well marked case of it; and chiefly because the medical opinion respecting its nature and treatment has been, and for aught I know, still continues to be, much divided. For whilst one, considering it as properly inflammatory, recommends the use of the lancet, and other depleting measures; another, viewing it as principally nervous, prefers an antispasmodic course; whilst a third, not reducing

it to any particular class or order, but treating it as a mere lusus naturæ, has recourse to specifics.

The object of this essay is not to introduce any specific remedy, or new discovery made by the author, for he pretends to none; but it is to invite, yea to urge, a more close attention to the discoveries already made, and laid before us; for it is believed, that these, if duly attended to, would prove amply sufficient to extricate the medical mind from its present embarrassing dilemma, and remedy the evil of which we complain.

The remedy here sought, all will agree, consists in a thorough investigation of the real nature of the disease. For if physicians were once agreed on this point, they could not widely differ respecting the proper mode of treatment. But so long as one physician believes the disease to be principally spasmodic, and another, that it is directly inflammatory; so long will their prescriptions not only be different, but, as it respects some of the fundamental parts of the treatment, diametrically opposite. They cannot both be right, though they may, each of them, appeal to what they deem facts, or the success of their practice, for their justification. For there are cases of all diseases so mild, that the patient might recover from them even under a very improper mode of treatment. Hence the importance of great circumspection in drawing practi-

cal conclusions. For though we admit, that experience is a good teacher, and that success is a just recommendation of a man's practice; yet we must likewise allow, that, unless we adapt our remedy to the nature, and other circumstances of the disease, we draw a bow at a venture, which the most ignorant pretender may do, as well as we.

The knowledge of the real nature of the disease being so very important, how, it may be asked, is this most desirable object to be obtained? To which I answer, it may be obtained in two ways: First, by a close attention to the testimony of those worthies, who have gone before us, who have carefully examined the bodies of those who have fallen victims to the disease, and who have faithfully transmitted to us the result of their discoveries. And, secondly, by the frequent and careful employment of the dissector's knife ourselves. For it is by dissection alone, that we are enabled to trace to their source many of the symptoms of some of the most abstruse and dangerous diseases. How vague and hypothetical must have been our ideas of their nature, and how unfounded and empirical our practice, in almost all diseases dependent on some internal affection, were it not for the light thrown on the subject by dissection. It is substantial knowledge thus obtained, that distinguishes the real physician, a noble and dignified character, from the base impostor, who sports

with the life of his patient, to get possession of his purse strings!!

A SKETCH OF THE HISTORY OF CYNANCHE TRACHEALIS.

THIS species of quinsy, it is probable, was not distinctly known to the ancients, since they have left us no particular account of it. But that the disease did exist in ancient times, and that the ancients had some confused notions of it, is likewise rendered probable, by this circumstance: they mention the occurrence of cases of Angina, in which there was no appearance of either inflammation or swelling in the fauces or neck, which they deemed peculiarly dangerous. The words of Hostius are these: "Gravis et illa species Anginæ, cum gutturis interni musculi sic inflammantur, ut neque in faucibus neque in cervice quidpiam appareat; unde CELSO merito pestiferus, GALENO maxime peracutus, HIPPOCRITE vero lethalis, dicitur." But whether these singular instances were or were not, cases of real croup, I pretend not to determine.

THE merit of the first discovery of the croup is attributed to several authors. But we, in this country, are indebted for the first particular description of it to Dr. HOME of Edinburgh, who published an ingenious treatise concerning it, under the appellation of Suffocatio Stridula, or Croup, in 1765. But MICHAELIS issued a work

on the subject at Strasburg in 1778, denominating the disease Angina Polyposa sive Membranacea, in which he says, that MARTIN GHISI, an Italian physician, gave the first regular account of it, in a medical production, (Lettere Mediche,) published at Cremona, in 1749. Since which time many learned professors and other ingenious practitioners, in this, as well as in other countries, have favoured the world with their interesting observations on this truly alarming, and too often fatal disease.

CYNANCHE Trachealis is not peculiar to the age of childhood, as Dr. HOME supposed it to be; for adults are sometimes the subjects of it. But it much more frequently attacks children between the time of weaning, and that of twelve years of age, than at an earlier, or later period of life. I have seen an infant at the breast, only ten months old, most severely attacked by it; but the child was of an extremely corpulent habit. The case of one adult only has fallen under my own observation. This was a maiden lady, who scarcely ever enjoyed what might be called tolerable health; but who habitually laboured under a high degree of dyspepsia, and suppressio mensium. And it is said, that WASHINGTON, the political Father of our country, fell a victim to this cruel disease!

DIAGNOSIS OF THE CROUP.

In giving the diagnosis of this disease, I shall divide the symptoms into two classes. The first class comprises those symptoms, which, though they usually accompany it, do not distinguish it from other febrile diseases. These are called its concomitant symptoms. The second class embraces only those symptoms which are peculiar to the croup, and distinguish it from all other diseases. And these are called its diagnostic symptoms.

1. *Of the concomitant symptoms.* These are no other than the symptoms of the fever, which accompanies the disease. And the fever attending the croup, may be either a synocha, or a typhus, or it may hold an intermediate rank between these extremes, according as the patient happens to be in a vigorous and firm state, or of a slender and delicate habit, or possessing a state of health between these extremes: for the fever commonly bears a proportion to the general state of the system, whether it be strong and robust, or weak and delicate. All that is necessary to be observed, therefore, respecting the concomitant symptoms is, to impress on the mind the necessity of distinguishing between the febrile symptoms; because on a just discrimination of them depends the application of the remedies about to be proposed.

The febrile symptoms accompanying a true synocha, are those which originate from bodily strength and vigour, resulting in a high degree of general excitement, and which are distinguished by a flushed countenance, great heat and thirst, with a full and strong pulse considerably increased in frequency. This state of the fever, at the same time that it calls for a bold application of the depleting remedies, denotes likewise that the patient will bear it, as such patients very frequently recover.

On the other hand, the symptoms of typhus are, a pale dejected countenance, little heat or thirst, with a pulse considerably increased in frequency, but small, weak and obscure. These symptoms, as depending on general debility, exhibit a caveat written in capitals, respecting the treatment of the disease; and at the same time that they admonish us of the inability of the patient to bear any great evacuations, they portend the greatest danger. For almost the whole number of patients, which I have lost in the croup, have been of this description.

These are the two extremes in the form of fever in croup. But in practice we shall find it occupying all the intermediate grades, and requiring the adaptation of our remedies to each.

2. OF THE DIAGNOSTIC SYMPTOMS.

The symptoms which distinguish the croup from all other diseases, are to be found, 1st. in

respiration, and the manner of breathing; 2dly, in the peculiar sound of the voice, and the manner of uttering it; 3dly, in the appearance of the countenance; and 4thly, in the deglutition.

1. The respiration is extremely laborious, and performed with a peculiar wheezing sound. And sometimes there is a kind of rattling noise, as though something hung loose in the trachea. The dyspnœa is so great, that the abdomen is thrown into great commotion. For the scrobiculus cordis and hypochondria are depressed or drawn inwards in a very remarkable manner, at each inspiration; whilst the abdomen is formed into a very prominent tumour near its centre, at each expiration; and these motions of the abdomen alternate with each other at each inspiration and expiration.

2. The peculiar sound of the voice, in the croup, is not easily described. Dr. Home compares it to the crowing of a cock; "vox instar cantus galli." But this appears not to be a very near resemblance. Whilst Dr. Cullen more justly describes it, as resembling that of the passing of air through a brazen tube, meaning thereby, I presume, the hard and sharp sound of a trumpet. But I suspect too great stress has been placed on its shrill sound; and that writers, since Dr. Home, have been too obsequious copyists. My own observation justifies me in stating, that the sound of the voice first impresses the mind with the idea of a great degree of

hoarseness, and as though it stuck to the fauces, requiring an unusual effort to utter it, and when it is thus forcibly uttered, it is always hard, and generally of a sharp or shrill sound. But it sometimes seems to consist of a hoarseness and sharpness blended together; that is to say, there appears to be a hoarseness, from the apparent difficulty of uttering it; and when thus forcibly uttered, it is hard and sharp. The maiden lady before mentioned, totally lost the power of vociferation, being able only to whisper, apparently from the extreme dryness of the trachea.

3. The countenance may be at first either florid or pale, according to the nature of the attending fever; but neither of these appearances is peculiar to the croup. But if, as soon as the dyspnœa becomes very distressing, the countenance puts on a livid or strangulated appearance, exhibiting at the same time some degree of bloatedness, these appearances, if accompanied by the two first mentioned diagnostics, may be considered as truly pathognomonic. And,

4. If amidst the foregoing distressing symptoms, the deglutition remain free and unimpeded, this circumstance amounts nearly to proof positive, that the disease in question is the croup.

The croup is distinguished from every other species of quinsy, by the absence of inflammation in the internal fauces, and by there being no impediment to swallowing. Whereas in the

other species of quinsy, the mumps excepted, the internal fauces are inflamed, and there is great difficulty in deglutition; for the soreness of the parts is such, that the attempt to swallow even a little liquid, is painful; and the liquid after passing into the nose, greatly disturbs the patient.

But the croup more nearly resembles a paroxysm of spasmodic asthma, in which the breathing is much the same. But it may be distinguished by these circumstances: the asthma is a chronic disease, returning by paroxysms, and leaving an interval of many hours between them, and is unattended by fever, especially in the beginning of the disease.

The four diagnostics above mentioned, are deemed sufficient to ascertain the presence of the croup, and when combined unequivocally, to distinguish it from all other diseases. I say, when combined; because, as in matters of jurisprudence, when several witnesses meet in the same case, and their testimonies agree, they corroborate each other, and their joint testimony is deemed conclusive. So in the case before us, it is the concurrence of these symptoms, not any one of them taken alone, which renders them completely pathognomonic; because they are not found thus combined in any other disease.

Having endeavoured clearly to point out those different circumstances in the concomitant symptoms, *especially the fever*, which imperiously de-

mand our particular attention in the treatment of each individual case, together with the general state of the patient, on which this difference depends; and having likewise brought to view those unequivocal marks, by which the disease may be easily and certainly known: I shall proceed to drop a few words respecting its mode of attack, its progress, and its termination.

The mode of attack is various in different subjects. It sometimes makes its approach in a slow insidious manner, beginning like a common catarrh, attended by some cough, and a slight difficulty of breathing; which symptoms may run on gradually increasing, for two or three days, before the disease shall become distinctly marked. But at other times its attacks are more rapid and sudden, requiring but a few hours from the first appearance of indisposition, before it shall be completely formed. But however equivocal or diverse be its mode of attack, its symptoms, after the disease shall have been fully formed, will be the same.

The progress of the disease likewise varies: for in some cases its extreme violence may induce a fatal suffocation in twenty-four hours; but such cases do not often occur. But if it do not yield to the remedies employed, it most commonly runs on, from three to five days, and sometimes longer.

Its termination likewise is as diverse, as its accession, or its progress. But in order to form

a correct idea how this diversity is brought about, it will be proper to notice the several changes which, in the course of the disease the symptoms undergo.

The fever, which, in the first stage might have been a true synocha, will, nevertheless, as the disease progresses, and the strength of the patient becomes worn down, put on the form of typhus. And the pulse, which, in the inflammatory stage was full and strong, now, as the last mentioned circumstances take place, becomes weak and quick; and as the fatal period approaches, it is scarcely perceptible; while the extremities, losing their former warmth, are bedewed with a cold sweat. The mental powers, likewise, which in the first stage were unimpaired, now suffer a great deprivation. And the extreme restlessness, and frequent coughing, which formerly greatly harrassed the patient, now, as the sensibility becomes exhausted, likewise abate; till at length, the patient becoming more and more insensible of what he undergoes, apparently lies easier; whilst respiration, becoming more difficult, and the patient less conscious of the need of it, is not so frequent; till at last, death like a friend comes and relieves him from all his sufferings. Sometimes, however, the scene closes in quite a different manner. For the irritability may be such, that the high degree of dyspnœa, together with the extreme distress for breath occasioned by it, may throw the pa-

tient into profuse sweats, and induce convulsions, the immediate precursors of dissolution.

OF THE MORBID APPEARANCES AFTER DEATH.

NUMEROUS and highly respectable are the authorities, which agree on the following statement of facts.

1. THAT, on laying open the trachea of children who die of the croup, there is frequently, but not in all cases, found a preternatural substance resembling a membrane, of various thickness and tenacity, lining its inner surface, and generally adhering very slightly to its inner or mucous membrane. But in some cases this substance lies so very loose, that it can scarcely be said to adhere at all. Whilst in other instances it is found occupying the whole length of the trachea, and extending into the branches of the bronchiæ.

2. THAT, in adults, this preternatural substance has not been found: but instead thereof, there has been discovered an uncommon dryness of the inner surface of the trachea, with strong marks of inflammation.

3. THAT, in those cases of children, in which this preternatural substance is wanting, there is usually found a considerable quantity of very tough mucus, mixed with a pus-like matter, occupying the cavities both of the trachea and bronchiæ.

4. That, in those cases of children, in which this membranous substance forms a part of the disease, this mucous and purulent matter is found lodged in a greater or less quantity between this preternatural substance and the mucous membrane of these parts.

5. That, on removing this membranous substance and the mucous and purulent matter under it, no marks of ulceration are to be found; but that the traces of inflammation are generally very apparent. And that cases have occurred, in which no appearances of inflammation could be discovered: But that such cases are very rare.

6. That the lungs, in some cases discover no marks of disease; in other cases they exhibit all the morbid appearances observed after pneumonia.

7. And that small polypous concretions are often found in the large pulmonary arteries, and in the right side of the heart. But they are said never to occur, after this disease, either in the left ventricle, or in the aorta, which are generally found nearly empty.

OBSERVATIONS.

Under this head, I shall attempt the outlines of the ratio symptomatum, and also an explanation of some of the morbid appearances of the parts on dissection.

From a retrospective view of these symptoms and appearances, I am induced with Dr. Home and others, to believe, that the seat of the croup is the mucous membrane and glands of the trachea, and that the disease itself consists in an inflammation of these parts, and its consequences. This position is confirmed by the testimony furnished by dissection: For evident marks of inflammation of the parts were discovered in all the cases over which the dissector's knife had passed. It is stated, indeed, that in certain cases no inflammation could be found; but the same statement adds, that there was lodged in the cavities of the trachea and bronchiæ a quantity of very tough mucus mixed with a pus-like matter. Now it is well known, that purulent matter may be produced without any ulceration: but it is equally clear, that it cannot be produced without inflammation. The existence, therefore, of pus in the trachea, affords as conclusive evidence that inflammation had preceded its formation, as the swelling and redness of the parts. In those cases in which no inflammation could be discovered by dissection, it is probable the inflammation had been removed by the means employed; but the patient had become so reduced, by the use of these means, and by the violence of the disorder, that he was rendered unable to dislodge these offending materials from the cavities of the trachea and bronchiæ, and fell a victim to their oppression, after the inflammation had completely subsided.

An inflammation of the trachea having taken place, it most commonly occupies its upper part, but may extend itself thoughout its whole length, even into the branches of the bronchia.

OF THE EFFECTS OF AN INFLAMMATION OF THE TRACHEA.

In discussing the effects of tracheal inflammation, I shall consider, first, its effects on the solids; and, secondly, its effects on the secretions of the part.

1. Of the effects it produces on the state of the solids of the inflamed part. These effects, it is presumed, are similar to those produced by other local inflammations, some of these are the following: The vessels of the inflamed part become unusually distended, and many of the capillaries, which, in their healthy state contain a colourless fluid only, now become gorged with red blood; and there is deposited likewise in the cells of the tela cellulosa an unusual quantity of serous fluid; hence the swelling and redness of an inflamed part.

But such is the nature of inflammation, that, whilst the changes in the state of the part, just mentioned, are taking place, it likewise effects an important change in the sensitive organs of the part. But in what manner this change is produced, we know not; but its effect is a morbidly increased sensibility of the part. Hence the unusual tenderness or soreness of an inflam-

ed part: for soreness consists in morbidly increased sensibility.

And furthermore, the distension or stretching of the fibres, whose sensibility is thus morbidly increased, occasioned by the swelling, produces the pain attending inflammation. And these circumstances of swelling and tenderness acting together, and occasioning a kind of immobility or stiffness in the part, prove the cause of that impediment to the motion of the part, which we observe in all considerable inflammations.

These being some of the effects constantly produced by inflammation let us apply this doctrine to an inflammation of the trachea.

The inner surface of the trachea becoming inflamed, the following changes in the state of the parts will take place. The mucous membrane and glands will become thickened or swelled, while the deposition of a quantity of serous fluid in the cells of the adjacent parts will further increase the tumefaction. The swelling of the parts thus produced, together with the soreness always accompanying inflammation, will occasion a degree of immobility in the motions of the vocal organs; whereby they will be rendered unable readily to adapt themselves to the position necessary to give the proper sound; and the same thickening of the lining membrane, by diminishing the capacity of the trachea, will render the passage of the air to and from the lungs more difficult: hence the laborious respi-

ration, and the peculiar wheezing sound with which it is performed, in the croup.

If we may be allowed to judge from the analogy between the vocal organs and wind instruments of musick, we shall be led to conclude, that whatsoever narrows the cavity of the glottis or upper part of the trachea, whether it arise from the thickening or swelling of its lining membrane occasioned by inflammation, or from the lodgement of a quantity of viscid mucus in its cavity, or from the formation of a preternatural membranous substance there, will have the effect to give to the voice a sharp or shrill tone. Agreeably to this we observe, that the position of the vocal organs, which gives the peculiar tone to the female voice in singing, consists in spreading the roots of the tongue, and so closing the larynx, as to leave but a very small aperture for the passage of the air, which gives to the female voice a pitch or tone an octave above the natural voice of a man.

And the immobility of the vocal organs, whether it arise from their tumefaction, their soreness, their rigidity or dryness, will have the effect to require an unusual effort in uttering the voice; and the voice when thus forcibly uttered, will of necessity be always harsh or hard; whilst the extreme dryness of the parts may totally suspend the power of utterance.

2. We shall in the second place, inquire into the effects of tracheal inflammation on the secretions of the part. These effects will be

various, like those of other local inflammations. For it may either suspend, or augment secretion in the part.

First, cutaneous inflammation suspends perspiration, as appears by the dryness of the skin of the inflamed part. Visceral inflammation likewise suspends secretion, which is evinced by the cohesion of the parts which often takes place: for the cohesion of these parts is owing to the defect of the secretion of that mucus, which in health is designed not only to moisten their surfaces, and cause them to slide over each other without attrition, but which, likewise, effectually prevents their cohesion. And there can be no doubt, that those cases of croup in adults were cases of this kind, in which, neither mucus nor any preternatural membranous substance was to be found in the trachea; but instead thereof, the mucus membrane was observed to be much inflamed, and uncommonly dry, secretion having been suspended on account of some peculiarity in the condition of the secretory vessels.

But in the second place, inflammation under a different modification of the secretory organs, is likewise observed greatly to augment secretion in the inflamed part. Examples of this occur, in cynanche maligna, in scarlatina anginosa, and in ptyalism from the exhibition of mercurials: in which cases the inflammation of the fauces and glands is accompanied by such an increased action of the secretory vessels, that

the slaver is observed to flow in almost a continued stream.

These different effects, which other local inflammations appear to produce on the secretory organs of the part, namely, that of sometimes suspending, and at other times of augmenting, the secretion, appear, likewise, to take place in tracheal inflammation. Thus, in the case of adults, secretion seems to be suspended, as appears from the parts being found inflamed and dry, as was before mentioned; whilst in children the inflammation appears to augment secretion, as is evinced by the large quantity of viscid mucus, with which the cavities of the trachea and bronchiæ are found on dissection to be loaded.

But whether inflammation suspend or augment secretion, one other effect, I believe, it never fails to produce, if secretion be not wholly suspended, and that is, it always vitiates the quality of the fluid secreted, by rendering it different from that which nature designed it to be. And this vitiated or altered state of the secreted fluid may probably consist in its being rendered, either too thin and acrid, or in its becoming too thick and glutinous. Thus in catarrh, the defluxion to the nares will sometimes be so thin and acrid, as to inflame, and even excoriate the parts over which it passes: whilst that to the fauces and bronchiæ will be so viscid and tough, as to require strong and repeated efforts, by

coughing and hawking, to dislodge it. This is further exemplified in the inflammation produced by the application of blisters; from which the discharge is sometimes limpid as water; at other times it is moderately viscid; whilst now and then it is so tough, as to form a coat of such tenacity, as to be capable of being peeled off entire, like a piece of skin.

Sometimes the secreted fluid is rendered so extremely glutinous and tough, in the croup, as to resist the feeble efforts of a child to dislodge it. In this case it must remain spread on the inner surface of the trachea, exposed to the drying effects of a current of air passing over it at every breath; by which means, its more aqueous part constantly escaping by evaporation, the residue is continually acquiring a greater and greater degree of consistence, till, at length, it becomes gradually converted into a solid, and forms that mysterious substance, which has been denominated a preternatural membrane, whose inner or concave surface will be the dryest and hardest, because it is exposed to the action of the air; whilst its outer or convex side will reremain moist and more soft, by its exclusion from the air, and by the new supplies of viscid materials, which, as the secretion still goes on, are constantly deposited betwixt this substance and the mucous membrane; and by which means also, this substance is detached from the mu-

cous membrane, and lies loose in the trachea, ready to be discharged, by the efforts of puking and coughing.

Drs. Home and Michaelis maintained the opinion, that this preternatural membrane constitutes the very essence of the croup, and is the cause of all its peculiar symptoms. Accordingly the latter of these gentlemen in his treatise on the subject, denominated the disease, angina polyposa sive membranacea, a name very appropriate; had this opinion been correct. And though the researches of Dr. Home were highly meritorious, and his discoveries most important; yet we are to remember, he was human. For his opinion, we have reason to believe, has been the cause of great perplexity to the medical world, till further inquiry had discovered the truth. For when a physician had a fatal case, strongly marked, by the most distinguishing croupy symptoms, if, on examination of the body, such a substance was not to be found in the trachea, he was at a loss what to call the disease; for by this criterion, it could not be the croup. This led to another opinion no less erroneous, namely, that the croup and cynanche trachealis are two distinct diseases. It is much to be regretted, that authors of acknowledged abilities should name a disease from some incidental circumstance, not essential to the disorder.

ORDINARY and easy respiration is performed in this manner: Inspiration is performed by enlarging the cavity of the thorax, and thereby giving the air an opportunity, by its own gravity, to rush in through the trachea, and inflate the lungs, by whose expansion the cavity of the chest thus enlarged, is exactly filled; for there can be no vacuum in the chest. And this enlargement of the cavity of the chest, is chiefly effected by the contraction of the diaphragm, which draws it downwards towards the abdomen, and thus enlarges the cavity of the chest: so that the perpendicular diameter of the abdomen is shortened, as much as that of the chest is lengthened, in inspiration. And expiration is effected by lessening the cavity of the chest, which expels just as much air from the lungs as the capacity of the chest is diminished. This diminution of the capacity of the thorax is effected partly by the relaxation of the diaphragm, but chiefly by the contraction of the abdominal muscles, which forces the diaphragm upwards into the cavity of the chest, and thus diminishes its capacity.

BUT in the croup, when the passage of the air to and from the lungs is much obstructed by the diminution of the cavity of the trachea, and the patient is in great distress for breath, the intercostals, and every other set of muscles, which can assist in raising and expanding the chest, and thus enlarging its capacity, are called into

action. And these several powers, by their joint and vigorous effort, do expand and enlarge it sufficiently for a full inspiration. But the obstruction to the passage of the air is so great, that the lungs become but partially inflated. And this partial inflation of the lungs, not being sufficient to fill the cavity of the chest thus enlarged, the diaphragm, whose contraction being overcome by the violent effort of the other contracting powers, is forcibly drawn upwards, contrary to its ordinary motion, into the cavity of the chest, to diminish its capacity; because the quantity of air inhaled, was not sufficient to fill it, it being impossible as was before observed, to leave a vacuum in the chest. And this retraction of the diaphragm into the cavity of the chest, occasions a remarkable depression or sinking of the scrobiculus cordis and hypochondria, at each inspiration.

And since as great an effort is required to expel the air from the lungs, as there was to inhale it, the obstacle being the same, the abdominal muscles violently contract themselves to force the diaphragm upwards, and by thus diminishing the capacity of the thorax, to expel the air from the lungs. And this violent contraction of the abdominal muscles compresses the viscera and forms them into a prominent tumour nearly in the centre of the abdomen, at each expiration. And these motions of the abdomen, though not noticed by any writer whom

I have consulted, yet, appearing to be constant attendants on all the cases of the croup, which I have witnessed, they are deemed of too great importance to be passed over, in ascertaining a case of this disease.

The same diminution of the cavity of the trachea, which occasions the dyspnœa, the wheezing, and the great commotion of the abdomen in respiration, and gives to the voice its peculiar croupy sound, occasions, likewise, a partial collapse of the lungs, which takes place in consequence of their not being duly inflated by each inspiration. And this collapsed state of the lungs proves an impediment to the free passage of the blood from the pulmonary arteries into the pulmonary veins; and this impediment gives occasion to an undue accumulation of blood in the pulmonary arteries, a state favourable to the formation of polypous concretions: for two circumstances are necessary to the production of these concretions, namely; a surcharge of blood, and an impediment to its free motion. And this constant distention of the pulmonary arteries will prove an obstacle to their receiving the usual quantity of blood from the right ventricle, by its contraction, whereby this ventricle cannot be completely emptied, but will remain partially filled with blood after each systole. And the right ventricle remaining partly filled with blood, will disqualify it for receiving, during its diastole, the usual quantity from the right

auricle; consequently the blood will remain unduly accumulated in both of these cavities, which will not only favour the production of these concretions in those cavities also, but likewise prove an obstruction to the passage of the blood from the vena cava into the right auricle; for this auricle, being constantly full, and able to discharge its contents but in small quantities, can receive the blood from the vena cava but slowly, which will prove a remora or clog to its motion in this last mentioned canal also; by which means the current of blood in the veins will be stemmed quite up to their capillary origin. And the impetus of the blood in the capillaries being too feeble to remove the obstacle thus opposed to its motion, these vessels in the last place will likewise become over-distended; the effects of which will be, a livid or strangulated appearance of the countenance, with some degree of bloatedness, which will pervade every part of the whole surface of the body or the whole capillary system. To elucidate this position I would observe, that, though the sudden distention of the capillaries by the arterial or red blood, will produce a blush; yet their gradual distention and the blood remaining partially stagnant in them as just mentioned, it will acquire its dark or venous hue; and it is the distention of the capillaries by this black blood, which gives the livid appearance. And one circumstance more tending to increase the lividity,

is the dark colour which the whole mass of blood acquires in the croup, by means of the defective chemical process performed in the lungs, of which more hereafter.

And as this strangulated appearance of the countenance depends on a state of the vital organs, similar to that of actual suffocation, it always affords an unfavourable prognosis. For the danger may generally be estimated, by the degree of lividity thus produced.

It is stated, that dissection could discover none of these concretions either in the left ventricle or the aorta; but that these cavities were found, after the croup, nearly empty. Here it will be proper to bear in mind a proposition before advanced, that "two circumstances are necessary to the formation of these concretions, an accumulation of blood, and some impediment to its free motion;" to which I will now add, that without the concurrence of the two circumstances, these concretions cannot be formed.

Now the same cause which occasioned the accumulation in the pulmonary arteries, namely, the difficult passage of the blood through the lungs, will effectually prevent this circumstance from taking place in the pulmonary veins, in the left ventricle, and in the aorta. For in proportion to the obstruction to the free passage of the blood through the lungs, will be its accumulation in the pulmonary arteries; and in the same proportion will the pulmonary veins be depriv-

ed of their customary supply from the pulmonary arteries. And as the veins receive, in a given time, say, from one systole to another, but a small quantity of blood from their correspondent arteries; so, of consequence they can transmit but a proportionately small quantity to the left ventricle, which can throw only the same paucity into the aorta. Hence it appears, that the above mentioned accumulation, without which these concretions are never formed, cannot take place, either in the pulmonary veins, in the left ventricle, or in the aorta: and therefore these concretions cannot be formed in these cavities. And furthermore, as a total collapse of the lungs takes place, on respiration becoming extinct; and as no blood, or at most but a very small quantity, can pass the lungs after their total collapse; and lastly, as the heart is known to act for a short space after respiration ceases; these circumstances clearly account for the left ventricle and the aorta being generally found nearly empty. But these last mentioned circumstances are not peculiar to the croup: they take place commonly, in a greater or less degree, in almost all other diseases. For we observe, that as the subject, whether man or beast, approaches the fatal period, respiration suffers a great interruption, and is less frequent, till at length, it becomes extinct. And, by a law of the animal economy, which Bichat denominates the contractibility of tissue, as respiration declines, a

collapse of the lungs commences, accompanied by a proportionate obstruction to the free circulation through them. By these means an accumulation in the pulmonary arteries, &c. takes place in the manner above described, which gives occasion to the formation of those concretions in the right ventricle, auricle, and large pulmonary arteries, which are often found, not only after the croup, but also after many other diseases. For the collapsed state of the lungs, which begins with the interruption of respiration, goes on increasing as this declines, till respiration ceases. In like manner the pulmonary veins, and consequently the left ventricle of the heart, being deprived of their customary supply of blood, this privation keeps pace with the increasing collapse of the lungs, till the collapse is complete, and the circulation ceases. And as the quantity of blood received by the left ventricle is constantly diminishing; so the quantity thrown into the aorta must become less and less, and the pulse will become proportionably smaller and weaker, till the quanity of blood thrown into the aorta becomes too small to reach the extremities, when the pulse will become imperceptible, which cessation of the pulse generally takes place some little time before the action of the heart entirely ceases. These circumstances, together with that of the heart's continuing to beat for a short space after respiration becomes extinct, account for the empty

state of the left ventricle and the aorta, after death, which are circumstances common to all diseases which terminate fatally, in a slow gradual manner.

But the collapsed state of the lungs above mentioned, needs some explanation. I would not be understood to mean by it, their perfect collapsion, as in the fetal state. For it is well known, that after the lungs have been once fully inflated, the greatest effort of expiration cannot expel the whole of the air from the bronchiæ, but a small portion of it will remain in the bronchial cells, which will prevent their total collapsion. But that which I would be understood to mean, is, that such a degree of collapsion takes place, in consequence of the lungs not being inflated, as proves an impediment to the free passage of the blood through them. And do any doubt the truth of the position, that the collapsion of the lungs proves an impediment to the free passage of the blood through them? Bichat, by sundry experiments seems to disprove it; but in the sequel he virtually acknowledges its truth, by conceding, that, in all cases attended by difficult respiration before death, the lungs are found unusually gorged with blood. If it be not true, why did nature, who does nothing in vain, make provision for carrying on the circulation through the foramen ovale in the fetal state, whereby the blood goes immediately from the right to the left ventricle, without pass-

ing through the lungs? Was it not, because the whole volume of blood could not pass through the lungs in their collapsed state? The truth appears to be this: a certain portion of the blood may pass the lungs in their collapsed state: but their collapsion, nevertheless, proves an impediment to its free passage, whereby an accumulation in the pulmonary arteries, and a proportionate paucity in the pulmonary veins, are occasioned.

It is an established principle with physiologists, that oxygen gas or vital air is indispensable to the support of animal life. For whatever be the chemical operation carried on in the lungs by respiration, whether the oxygen becoming absorbed, and united with the blood, give to it its bright and scarlet colour, and endow it with its vivifying and exciting qualities; or whether, by chemical attraction it abstract from the blood its carbon formed in the course of circulation, and uniting itself with it, be converted into carbonic acid gas, and thrown out by expiration; these are questions whose discussion does not necessarily fall under the present inquiry. But the indispensable necessity of the admission of a certain portion of oxygen gas into the lungs, in order to support life, and the consequences of the total absence of it, as well as of its admission in a quantity too small to answer the exigencies of the animal economy, are subjects immediately interesting to the present investigation.

In regard to the quantity of oxygen gas necessary to support life and health, the results of different experimentalists are not exactly the same; though, all circumstances considered, they do not so widely differ, as might be thought at first glance. I shall therefore take as the standard, that of Sir Humphry Davy, whose accuracy and acumen are unquestionable. According to his researches, a middle sized man ordinarily respires about 216,685 $\frac{15}{21}$ cubic inches of common atmospheric air in 24 hours. This quantity, allowing 100 parts of common atmospheric air to contain 21 parts of oxygen gas, which is the common estimate, will give 45,504 cubic inches of oxygen gas. But on account of some trifling circumstances best known to himself he was induced to fix his calculation at 45,500 cubic inches of oxygen gas in 24 hours, weighing about 15,500 grains,=2 lb. 8 oz. troy weight; and that, on an average, about 31,6 cubic inches of oxygen gas are usually consumed by a man in a minute.

The effects of a total obstruction to the admission of oxygen gas into the lungs are these: the chemical process in the lungs is instantly suspended, and the blood passing into the pulmonary veins, is conveyed to the left chamber of the heart in its black and venous state, (except it be a little reddened by a small quantity of oxygen gas remaining in the lungs when the obstruction took place,) and is thence thrown through the

whole aortal system, and thus caused to penetrate every organ of the body. And as the black or venous blood is destitute of those vivifying and exciting powers, which the red or arterial possesses, the several organs soon experiencing its paralyzing effects, their several functions cease, and death ensues. That great experimental Professor, Bichat, treating of the manner in which the death of the lungs produces the death of the other organs, says, "I believe, on the contrary," (i. e. in opposition to the opinion of Dr. Goodwyn,) "that in the interruption of the chemical phenomena of the lungs there is a general affection of all the parts; that the black blood, driven every where, carries weakness and death to every organ that it enters; that it is not from their not receiving blood, but from their not receiving red blood, that each organ ceases to act; and that in a word, all are then penetrated by the material cause of their death, namely, black blood." *Researches*, Part II. Art. VI. § 2.

So likewise, by parity of reasoning, when the quantity of oxygen gas admitted into the lungs is too small to answer the several exigences of the animal economy, it may indeed support life for a while; but the several functions must be carried on in the interim in a very imperfect and debilitated manner. Accordingly, we find by the records of distinguished experimental chemists, that the first symptom supervening on a deficiency in the quantity of oxygen gas in

the respired air, is a disposition to drowsiness; and as the deficiency increases, laborious respiration and universal distress manifest themselves. Mr. Ellis and Dr. Higgins observe, that debility, convulsions and death, follow the successive diminution of the oxygen gas, long before the whole of that gas is consumed. See Ellis's Inquiry. Minutes of a society, &c. page 160.

These observations being premised, let us apply the doctrine to the case before us. And here the mechanical obstruction opposing the passage of the air into the lungs, being the diminished capacity of the trachea, is such, as may reasonably induce us to suppose, that not more than one half, and sometimes perhaps not a third part, of the usual quantity of air is inhaled into the lungs, by respiration, in the croup; consequently but a proportionate quantity of oxygen gas can be admitted, and the chemical process will be but in that ratio performed; and of course the animating and invigorating effects derived from respiration will be in the same proportion: or, in other words, a degree of debility proportionate to the deficiency of oxygen gas inhaled, must be induced. And the excitement of the several organs, by the blood thus deteriorated, must be in the same ratio diminished. The energy of the brain, therefore, being thus reduced, the patient will fall into a dozy state, bordering on insensibility; the action of the heart, being in the same degree debilitated, the

pulse will become weak and obscure; the sensitive organs suffering in the same manner and degree, sensation will be equally obtunded, and the patient becoming unconscious of that restlessness and distress, which, in the first stage of the disease greatly agitated him, he will lie apparently calm and easy; and lastly the moving powers suffering an equal privation, the patient will appear in a very debilitated state, seeming scarcely able to move a hand or a foot. And on these principles that remarkable change in the symptoms of the croup, from the inflammatory to the typhoid form, which is observed to take place, as the disease advances, may, I conceive, be rationally explained. And I would ask, may not the paucity of oxygen gas received into the lungs, and the proportionately deficient chemical operation carried on in them, during the whole course of the disease, be a principal cause of this change, and of the great prostration of every power and faculty attendant on the last stage of the disease? This remarkable change in the symptoms is most conspicuous in those cases, in which the first or inflammatory stage exhibits the marks of great general excitement, which, as has been before observed, depends on a proportionate degree of bodily strength and vigour. But in those cases in which the patient labours under great constitutional debility, and the symptoms in the first stage put on the typhoid form, this change in the symptoms cannot

be so apparent. But even in these debilitated cases, observation will discover, that the prostration of every power and faculty is much more rapid, in the croup, than that which usually occurs, from the debilitating effect of disease simply considered. Hence we may justly conclude, I conceive, that the excessively debilitating effects of the croup, are to be attributed to the paucity of oxygen gas inhaled, and the consequent imperfect or deficient chemical operation performed in the lungs.

THE PROGNOSIS.

Many of the circumstances, which, in the croup, portend danger, were noticed as I went along. It may not be improper, however, to exhibit a collective view of them, which I shall present in an aphoristical form.

1. In the beginning or first stage of the disease, if the concomitant symptoms be of the low, depressed, or typhoid kind, there is much reason to fear an unfavourable termination, because, in these cases the patient does not so well bear, nor receive so much relief from, the necessary evacuations.

2. If the patient do not bear the depleting measures, it affords an unfavourable prognosis.

3. If the cough, which, in the first stage was frequent and troublesome, abate in the advanc-

ed stage, whilst the dyspnœa remains unabated: or,

If the great restlessness and distress attending the first stage, abate in the advanced stage, and the patient appears to lie calm and easy, whilst the dyspnœa suffers no diminution: or,

If the mental powers, which, in the first stage were free and unimpaired, become depressed in the advanced stage, and the patient sinks into a drowsy state bordering on coma, whilst the respiration remains as difficult and laborious as before: either of these circumstances are of fatal omen; for they do not denote an abatement of the disease, but the loss of sensibility.

4. If the dyspnœa be great, and the means employed do not relieve it, no flattering appearances which may take place, can be relied on.

5. The danger will generally be in proportion to the degree of dyspnœa and the strangulated appearance of the countenance.

OF THE METHOD OF TREATMENT IN THE CROUP.

The result of the foregoing inquiry leads to the following conclusions: that the croup primarily consists of an inflammation of the mucous membrane of the trachea, which extends likewise to the mucous glands of the part. And that, in consequence of this affection, there becomes deposited in the cavity of the trachea in children only, and sometimes likewise in the

bronchiæ, a quantity of viscid mucus and other offending materials, which, if not dislodged, may prove fatal, even after the inflammation which occasioned the deposition, shall have completely subsided. The indications therefore, which I shall propose, are two:

1. To remove the inflammation: and

2. To dislodge those offending materials deposited in the trachea and bronchiæ.

The inflammatory diathesis consists in an undue fulness and tension of the vessels: and it may be general, or local. When the inflammatory diathesis pervades the whole system, strong marks of general excitement appear, as a florid countenance, a full and strong pulse, great heat and thirst, and the fever attending it is always a synocha. When it is local, and confined to a particular part, it occasions very little general excitement, and the countenance will be pale, the pulse weak and small, the heat and thirst but little increased, and the fever will be of the typhoid form.

I. To answer the first indication, the means are those which deplete and relax the system; such as, venesection, emetics, cathartics, blisters, and the warm bath.

In order that venesection may have the greatest effect possible, in depleting and reducing the tension of the system, and thereby removing inflammation, it should be conducted in the following manner. The blood should be drawn

suddenly, from a large orifice, made as near the part affected as possible, and the blood suffered to flow till some marks of deliquium supervene. I have generally preferred the external jugular in cases of croup, and I perform the operation in this manner: Lay the child horizontally on its side, in the lap of an assistant, with the upper side of its neck and shoulder bare, its head a little depressed, and held steady by another assistant, its hands likewise being kept out of the way. Then placing the thumb of the left hand on the vein to prevent the loose skin from giving way before the point of the lancet, and holding the lancet in the right hand, so as to form an acute angle with the surface of the skin, plunge it into the vein a sufficient depth, bringing it out, not by drawing it back, but by tipping out its point, so as to make the orifice in the skin at least as large as the opening in the vein, which will effectually prevent the blood from forcing its way into the cellular substance and forming a thrombus. If the vein should not fill, make the child cry, and that will fill it immediately. The bad work sometimes made in blood-letting, must apologize for these minutiæ. After a sufficient quantity is thus taken away, the finger applied to the orifice, and held upon it for a minute or two, will generally stop the blood, when a compress of dry lint applied to the orifice, and a bandage over it, and passed slightly round the neck, will

generally secure it. In opening the jugular, if we do not make the opening deeper and larger, than we should deem necessary in the arm or ankle, such is the loose and spungy texture of the part, that we shall find ourselves disappointed in procuring a free discharge of blood.

In these cases of croup, in which the fever is of the typhoid form, known by the pale dejected countenance, by the weak, quick, or obscure pulse; and by the small degree of heat and thirst, and other marks of general debility; if we take away blood at all, we should do it with great precaution, and very sparingly, lest we should thereby increase the existing debility to such a degree, as should render the patient unable to discharge the offending materials deposited in the trachea, which if not dislodged, might prove as fatal as the inflammation itself. For the same reasons, in the advanced stage of the disease, after such a degree of debility shall have been induced, as shall have changed the febrile symptoms from the inflammatory, to the typhoid form, bloodletting has not been observed to be useful, and cannot be recommended. Under such circumstances it will be safer to trust to the other means about to be proposed.

In those cases of the croup, in which the febrile symptoms hold a middle rank, between the two extremes above described, we should use the lancet, but it should be done with some

precaution. Blood should be taken away in proportion to the degree of the febrile symptoms, and to the strength of the patient. It should be drawn early in the disease, but not before the febrile symptoms have somewhat increased, nor after they have put on the typhoid form.

2. Of emetics.—Emetics are better adapted to the typhoid form of the disease, than to the highly inflammatory variety. But they answer both of the general indications, by cleansing the stomach, determining to the surface, and equalizing the circulation; and thus they prove both antispasmodic and febrifuge: And they are decidedly the most powerful means of dislodging any noxious materials from the cavities of the trachea and bronchiæ. They should be plied vigorously, and repeated as often as the strength of the patient will bear, till the disease abates, say, once in 12 or 24 hours.

If the patient be strong and vigorous, I commonly take equal parts of tartris antimonii and submurias hydrargyri, adding to them a sufficient quantity of hot water, and of loaf sugar enough to keep the submuriate suspended till it can be swallowed. Of this I give a quantity, which I consider to be a middling dose, and repeat it every half hour, till it operates freely as an emetic, or proves cathartic. After it shall have operated sufficiently, I exhibit a dose of tinct. opii. camphorat. to allay or obviate

any spasmodic affection, which the dyspnœa and distress has, or may induce. And if the emetic shall not in a reasonable time prove cathartic, I exhibit a proper dose of calomel to move the bowels freely.

But the tartrite of antimony, as an emetic, is proper only in the first stage of the croup: nor is it safe in this stage of the disorder, unless the patient possess a good degree of bodily strength and vigour. For since writing this dissertation, subsequent observation has furnished the author with one very important fact, respecting the effects produced by the exhibition of a large dose of tartar emetic in certain cases which, at that time, he had not noticed. It is this: If tartrite of antimony be exhibited in a large dose, to a debilitated patient, in whom such a degree of torpor of the stomach has taken place, as to prevent it from producing any evacuation, it will act as a deleterious poison: for a most surprising prostration of strength will speedily follow, in which the muscles seem to have lost their tone, the patient appearing to be scarcely able to move a hand or a foot, whilst the energy of the brain appears to have suffered an equal privation; for the patient will lie in a state bordering on insensibility; a state from which he will be very fortunate if he recover. Similar effects from the tartrite of antimony the author has witnessed in more instances than one. For he knew a famous irregular

practitioner, whose practice it was, in the advanced stage of typhus, if the tongue was loaded and the skin dry, to put down a large dose of tartar emetic, with the view of cleansing the stomach and bringing on a diaphoresis, which, as he supposed, would break the fever: and as the stomach in these cases is generally pretty torpid, he frequently had occasion to repeat it, but often without producing any vomiting, but what was forced, by tickling the throat with a feather. The consequence of this practice was, the patients generally fell into a state similar to that just described, from which they seldom recovered. I return to the treatment of the croup.

If the patient be feeble in the beginning, or shall have become so, in the course of the disorder, we must make use of a more mild emetic adapted to the strength. For this purpose a strong preparation of oxymel scilliticum per se, or with the addition of a portion of the subsulph. hydrargyri flav. or ipecacuanha with from half a grain, to a grain and an half of the last mentioned mercurial, will be the best; which should be repeated according to the violence of the disease, and as the strength of the patient will allow; the object being to push the operation vigorously; as there is no time to be lost.

3. Of Cathartics.—Cathartics, though better depletives, and consequently better calculated to reduce simple inflammation, than mere emetics; yet as emetics seem to answer both of the

general indications, they claim the preference. But during the inflammatory stage especially, if the emetic do not operate downwards, it should be followed by some kind of cathartic, of which calomel seems to be the best. During the course of the disorder, it is of importance to keep the bowels open, to avoid costiveness. And to answer this purpose the castor oil is well calculated. It may be exhibited at any time in a quantity sufficient to answer this purpose, except during the operation of the emetic.

4. Of Epispastics.—These are of great consequence in removing the local inflammation, and should in no case of the croup be omitted. After bleeding, if proper, and once puking, a blister should be applied to the fore part of the neck, extending half round it. If the wheezing seem to proceed from the lungs, the front and sides of the chest should likewise be blistered. I think that blistering the chest was the means of saving one of my patients.

5. Of the Warm Bath.—The warm bath acts by exciting torpid vessels into action, by soothing the tender fibres painfully distended by inflammation, and by thus equalizing the circulation proves the most speedy assuager of the pain of local inflammation hitherto known. It will procure a temporary mitigation of the distress in croup; but how far it will contribute towards effecting a radical cure, must be left to future experiments to determine.

II. The second general indication proposed, was, to dislodge those noxious materials deposited in the cavities of the trachea and bronchiæ. This is a very important indication, because, if this be not answered, though we should be able completely to remove the inflammation, the patient must sink.

The most effectual means of answering this indication consists in repeated puking, and in promoting expectoration by keeping up the cough. To excite coughing, I know of nothing equal to the polygala senega, which may be exhibited in decoction, after the manner of Dr. Archer, or in a fine powder mixed with lac ammoniacum, or a syrup of squills. My common practice, in the intervals between puking, consists in exhibiting the seneka in one or the other of these forms, every two or three hours, interposing between each dose, a moderate quantity, say, from one to three grains of submuriate of mercury, to act on the glandular system. If in any stage of the disorder the coughing ceases, while the dyspnœa continues unabated, I give from three to five grains of the fine powder of seneka, or of Ipecac. with from one to two grains of the yellow subsulphate of quicksilver, to promote a moderate puking; as a substitute for the deficient coughing and expectoration, omitting at this time the submuriates. I have never known a troublesome ptyalism to follow the free use of

mercurials exhibited in this manner. The diet should be sparing, consisting only of the liquid kind, and the drink should be some emollient pectoral infusion.

There is one article more, which, as some people deem it a specific in the croup, it may not be improper to mention, which is the adeps boiciningæ, or rattle-snake's oil, as it is called. In support of its great efficacy and penetrability, it is alleged, that being rubbed on the throat, it soon becomes distinctly tasted in the mouth. To this effect from its external application, I can add my own testimony; but whether the effect be produced by its penetrating to the internal fauces, or by its effluvia being inhaled with the breath and lighting on the papillæ of the tongue, I am at present unable to determine. From its extremely fishy and nauseous taste, it certainly will produce puking, and, I think I have witnessed its good effects. It is given to a child in the quantity of about a common tea-spoonful, by itself, and in half an hour, or an hour, according to the intention of its exhibition, it may be safely repeated.

In the advanced stage of the croup, when the circumstances mentioned under No. 3, of the prognosis supervene, might not the inhalation of oxygen gas, frequently repeated, invigorate the debilitated system, and help to restore the diminished sensibility, and thus prove an important auxiliary in the cure? The foregoing investi-

gation, to say the least, will fully justify in the author's opinion, our giving it a fair trial.

A BRIEF HISTORY OF A FEW CASES OF CROUP.

NOTE,—In the following cases, where it is not otherwise particularly expressed, a moderate dose of elixir paregoric, as it was formerly called, was always exhibited after venesection, emetics, cathartics, and at bed-time, to obviate spasms, to relieve the distress, and to procure rest; and in the intervals between the operation of evacuants, from one to three grains of calomel, according to the age of the patient, were prescribed, to be repeated every three or four hours, according to the urgency of the symptoms, till the disorder should abate. Notwithstanding this free use of calomel, I have not met with a single case of troublesome ptyalism, resulting from it. In regard to venesection, it does not appear very important from what part the blood is taken, provided the necessary quantity be abstracted suddenly, by a large orifice that will let the blood flow in a full stream. Consequently, to obviate that horrour with which mothers are often struck, at the idea of opening the jugular, I have, where the circumstances appeared favourable, generally taken the saphena.

CASE I.

SEPT. 4th, 1795. A child 3 years old. The respiration very laborious, with wheezing; ac-

companied by great commotion of the abdomen; some cough, with a sharp sound of the voice; the countenance flushed, with a strangulated appearance; the pulse full, strong, and considerably increased in frequency, and the heat and thirst proportionate, with great restlessness.

Blood was taken copiously from the ankle, which greatly relieved the dyspnœa, and the general distress.

In two hours an emetic of tartrite of antimony and submuriate of quicksilver was exhibited, which operated freely, and so far removed the remaining distressing symptoms, that the child had a good night.

5th. The dyspnœa, fever, and other symptoms having chiefly subsided, a cathartic of equal parts of calomel, jalap, and crystals of tartar, was ordered; which operating well, the child recovered according to our wishes.

CASE II.

Nov. 4th, 1796. A child 3 1-2 years old. Great dyspnœa, with much wheezing, which seemed to extend into the chest, with great abdominal commotion; the countenance pale and dejected, with a pallid lividity; vociferation difficult, and the voice when uttered, either by coughing or speaking, hard and sharp; the heat moderate; the pulse quick, small and obscure.

As the child discovered strong marks of general debility, it was thought expedient to omit the use of the lancet, though the case appeared alarming.

An emetic was ordered; but, from the timidity of the mother, the operation was not so full, nor so often repeated, as it ought to have been; blisters were applied on each side of the trachea; as the bowels inclined to costiveness, they were kept open by castor oil and injections; and in the intervals, small doses of calomel, and a decoction of seneka, were ordered to be given alternately; but, on account of the disagreeable taste, she took but little of the latter. And thus she went on for three days, without any abatement of the disease.

On the 3d day, her case being viewed as nearly desperate, a large blister extending from the clavicles, to the lower part of the sternum, and occupying nearly a third part of the chest, was applied, and the course above mentioned, continued. The result was this: as soon as this blister vesicated and discharged, the dyspnœa and every other distressing symptom gradually abated; so that, in two days more, every croupy symptom subsided. The blisters being beset with ulcers, were extremely painful, which greatly reduced her; but by the free use of bark and other restoratives, she recovered in about a fortnight.

CASE III.

April 6, 1797. A child 22 months old, of a very gross habit, violently attacked; dyspnœa distressing, with much wheezing, and great abdominal commotion; the countenance suffused, with a bloated and strangulated appearance; pulse full and strong, and the heat and thirst much increased; vociferation difficult, and the sound of the voice, whether by coughing, or crying, hard and sharp, with constant restlessness.

All attempts to find a suitable vein in the ankle or arm were fruitless; I therefore turned to the jugular, which I opened without difficulty; the blood flowed copiously, till marks of faintness supervened, and the child puked once, which greatly frightened the anxious mother, but as greatly relieved the distressed child.

In about an hour after the exhibition of the paregoric, I gave the antimonial tartrite and calomel mixture, which vomited the child very freely, and passed downwards twice. These operations so far removed the complaint, that, aided by a mild pectoral tea for drink, with the paregoric at bed-time, the child had a good night. By continuing this course for two days longer, assisted by ol. ricini occasionally exhibited, so as to keep the bowels open, the child recovered without the use of any other remedies, and without further trouble.

CASE IV.

JUNE 4th, 1782. A lad between seven and eight years of age, having been much fatigued, by riding horse to plough in a hot day, ate his supper and went to bed, apparently, in good health. He slept in a garret against an open window; and the weather turning remarkably cool in the night, he awoke towards morning in great distress for breath, complaining of much uneasiness in the fore and upper part of his neck, just below the roots of his tongue, which, he said, did not interrupt his swallowing, but seemed to choke him, as he expressed it.

BEING called on in the morning to visit him, I found him labouring under the symptoms of a well marked violent croup. On inspecting the internal fauces, neither tumour nor inflammation could be discovered. The countenance was flushed, and somewhat livid; the general excitement was very considerable, the pulse full and strong, and the heat much increased; the dyspnœa was distressing, accompanied by wheezing, and abdominal commotion; utterance difficult, and the sound of the voice was hoarse and hard, but not shrill; and there was some cough, which was not urgent.

BLOOD was taken freely from the ankle, which in some degree relieved the dyspnœa. After a short respite, an emetic of the antimonial tartrite with calomel was exhibited, which, operat-

ing copiously gave still further relief. This was followed by two grains of calomel every four hours, interposing half a common table spoonful of the following mixture between each dose: take of lac ammoniacum ʒij. oxymel scilliticum ʒj. and elixir paregoric ʒij. mix.; a mild pectoral tea for drink.

June 5th. The symptoms in some degree mitigated; but respiration remained laborious, with too much heat and thirst, and a full and strong pulse.

Venesection, and the emetic, repeated as yesterday, and the other remedies continued, with the addition of an epispastic applied to the fore part and sides of the neck, and a tea spoonful of adeps boiciningæ interposed every six hours.

June 6th. The symptoms greatly relieved. But there was observed an uncommon rattling in respiration, as if something hung loose in the trachea. In the course of the day, the patient brought up, by coughing, several pieces of a skinny substance, much resembling the skin peeled off from the under side of a boiled neat's tongue, some of which were more than an inch in length, and nearly half an inch in width. The calomel and pectoral mixture were continued for two days more; at the end of which, every croupy symptom had subsided, leaving a very slight affection only of the mouth, from the liberal use of the calomel.

CASE V.

Nov. 1st, 1806. I was called in the evening, to a child at the breast, 12 months old, who appeared to labour under all the symptoms of a well marked and violent croup. Respiration was very laborious, and performed with wheezing; when the child coughed or cried, it seemed to be with difficulty, that it could make a noise; but when uttered, the sound was sometimes hoarse and hard, and at other times squeaking and sharp; the pulse was pretty full, and increased in frequency, and the heat augmented. The countenance was flushed, and exhibited the strangulated appearance.

The child's mother then gave the following history of the case. She said, she was holding the child in her lap, about noon that day, and eating chestnuts; and the child looking wishfully after them, she put some of the nut that she had chewed, into the child's mouth, several times, which it swallowed with apparent avidity; at length, as she was thus feeding it, the child coughed as though it was choked. The difficulty of breathing instantly commenced, and has been increasing ever since. She was afraid some of the nut had gone the wrong way.

The manner in which the disease came on, and the whole history of the case, afford reason to conclude, that the mother's fears were too well

grounded; notwithstanding I could discover no difference between the symptoms of the present case, and those of a common well marked croup.

Is the present disorder a case of croup? If it be not such a case, what is to be done? I reasoned thus with myself: the formation of a preternatural membranous substance, in the croup, depends on a preceding inflammation of the trachea; but the introduction of an extraneous substance into the trachea, and its remaining there, must occasion such inflammation, which will reduce the two cases to the same nature. The symptoms cannot be much different, and the indications must be the same, namely, to remove or obviate inflammation, and to dislodge, if possible, the offending material from the trachea. As the state of the febrile symptoms evinced a considerable degree of inflammation from some cause; and being unable with certainty to determine from which cause it might arise; I resolved to treat the present complaint, as a case of croup.

I therefore took blood freely from the ankle, which, for a while, appeared considerably to mitigate the dyspnœa. After a short respite, I gave an emetic, which, though it operated kindly and freely, seemed to afford no essential relief. This was followed by small doses of calomel, and the decoction of seneka, exhibited alternately, as usual in the croup.

November 2d. The symptoms generally aggravated, but more especially the dyspnœa, and the strangulated appearance of the countenance. On reflecting that venesection gave but momentary relief, and that puking afforded none; I was confirmed in the opinion, that the difficulty arose from the lodgement of an extraneous body in the trachea; and viewing the case as nearly desperate, I resolved to try the effect of puking with adeps boiciningæ. I therefore gave a tea spoonful of it by itself, and repeated it every half hour, till the child puked several times: and at length the child discharged, while puking, a solid piece of a chestnut, consisting of about a quarter part of a whole nut; on which the dyspnœa immediately abated, every distressing symptom soon subsided, and the patient recovered without further trouble.

CASE VI.

June 1st, 1811. A child at the breast, ten months old, and extremely corpulent, was violently attacked by the croup. Distressing dyspnœa, much wheezing, with great abdominal commotion; countenance flushed and strangulated; utterance difficult, and the voice hard and shrill; heat increased, with a full and strong pulse; some cough, with great restlessness, &c.

I took blood from the jugular vein, till paleness and some faintness supervened, which much relieved the dyspnœa and other distressing symp-

toms. After a short respite, the antimonial tartrite and calomel mixture was exhibited, which, puking her copiously, and passing downwards twice, so far annihilated the remainder of the disease, that a course of small doses of calomel alternated with small doses of paregoric, continued for 24 hours, and followed by a cathartic, completed the cure, without the use of any other remedies.

We should be more intelligible, perhaps, in speaking of the croup, if we were to divide the disease into two stages, the inflammatory, and the typhoid. Keeping this distinction in view, I would observe, that I have been frequently called on for advice in cases, in which the disease, under a weak or inefficient mode of treatment had been suffered to run without any abatement, for three or four days, or till the second or typhoid stage had been fully formed. Under these circumstance, I cannot say, that I have known a single recovery; venesection has mitigated the dyspnœa, but the relief was generally temporary only; whilst the depletion increased the general debility, a circumstance most to be dreaded in this stage of the disease. Full vomiting often produces similar effects. As in this stage of the disorder, there is usually such a degree of torpor and insensibility induced, as renders the operation of emetics very precarious; we ought to be extremely cautious in the use of those of the dras-

tic kind, but more especially of that of the tartrite of antimony, for the reason heretofore given. In the typhoid stage, our chief reliance must be placed upon blistering, which should be largely employed, stimulant expectorants, such as seneka, squills, and the yellow oxyd of quicksilver. These may be exhibited with safety, so freely as to produce gentle puking occasionally, as the case may require.—To these may be added the use of the warm bath, and may I not add, the frequent inhalation of oxygen gas? But if the more efficient remedies have been omitted in the first stage, we can promise ourselves very little from the employment of any means whatever in the second.

THE END.

ARTICLE III.

A

DISSERTATION

ON THE

NATURAL HISTORY AND MEDICINAL EFFECTS

OF THE

SECALE CORNUTUM, OR ERGOT.

By OLIVER PRESCOTT, M. D.
Fellow of the Massachusetts Medical Society.

Read at the annual meeting, June 2nd. 1813.

The attention of physicians, which has been laudably excited to the investigation of the properties of our native productions, has been recently followed by many valuable discoveries; and these happy results, while highly useful to the public, are a powerful incentive to further exertions. The bosom of our country contains very many plants, not hitherto drawn from their native obscurity; some are already known to be endued with very active powers, and we are encouraged to hope, that, when their qualities shall be completely developed, and the medical

purposes to which they may be applied, more fully ascertained, no small number will be entitled to a high consideration in therapeutics, while some may be found possessed of energies, competent to remove maladies which have hitherto been considered incurable.

Among the useful and important articles with which the *materia medica* of our country has lately been enriched, *one* has claimed an extraordinary degree of attention, from its being endued with singular and valuable properties, such as are denied to every other medicine with which we are acquainted ;—that of operating exclusively upon the *uterus.*

The recency of its introduction to medicinal use, will, I presume, render what little information I can give respecting it, not unacceptable to the society. Permit me, therefore, on this occasion, to attempt giving a brief detail of what has been discovered relative to its origin, its generic form and character; and at the same time consider, as far as the occasion will allow, the deleterious effects that have been ascribed to it, and the medicinal purposes it is calculated to subserve.

This production is generated by a peculiar disease, which occasionally affects the grains of rye, and is one of the four diseases of plants enumerated by Linnæus, and by him denominated *clavus ;* some naturalists call it *clavus secalinus,* or *mater secalis,* others *secale cornutum,* and *secale luxu-*

rians. The French term this production *ble cornu, seigle ergote,* or *ergot.* This disease very often attacks the rye in France. In the province of Salonia, more especially, it is very predominant; and in such seasons as are very moist, is occasionally seen in Great Britain and other parts of Europe. The rye in this country also, is so liable to the same disease, that, in our new settlements, there is always, I believe, more or less of it to be found in this grain; but it is more rarely to be discovered on fields that have been kept in a state of constant cultivation, for a considerable number of years; as those in the vicinity of Boston, and other towns on the sea-board.

The earliest account of this diseased rye is probably that of M. Dodart in 1676; the latest I have seen is a memoir of L'abbe Tessier, read before the Royal Medical Society in Paris in 1776. To this last I am principally indebted for the following facts relative to its natural history, most of which accord with my own observations.

This diseased grain, which I shall call *ergot,* is found in the ear of the rye, in greater or less quantity, according to the season, and its situation. Its form is ordinarily crooked and long; it projects much from the *glume;* is larger in the middle than at the extremities, which are sometimes blunt, and sometimes pointed. It is seldom round in its whole length, there being generally three angles, and certain longitudinal lines, ex-

tending from one end to the other. In many grains, particularly the largest, there are small cavities, supposed by some to be occasioned by insects, by others, by the sun. Its external colour is violet of different degrees of intensity, which encloses a dull white substance of a firm consistence, from which the external coat does not separate itself even after long boiling.

A grain of ergot breaks short, like a dry almond, and has nothing disagreeable either in its odour or taste; the grains are of different size, and vary in their length. Some are less than the grains of rye themselves, while others, are eighteen or nineteen lines in length, and two or three in thickness; but the length is more usually ten or twelve lines. Sometimes they are short, and at the same time large; but these are not of an ordinary form.

When the ergot is large, there are generally but few upon an ear, and the grains of rye, on the same ear, are fine and healthy, and the whole plant vigorous; on the contrary, when the grains of ergot are small, there are many on an ear, and the stalk is less strong and thrifty. There are commonly found four or five of these grains upon one ear, frequently ten or twelve, and sometimes, even twenty. The grains of rye in those ears which have many ergots are never good, but are shrunk, and covered at their superior extremity, with a black powder.

This production, if exposed to the air, dies readily, and becomes less in size, and very light. A measure of it, that holds fourteen pounds of rye, will weigh but nine pounds.

It is occasionally found on *wheat*, but on the ears of this grain it is always short, though thick and well nourished; the quantity, however, produced by this plant, is very inconsiderable.

On many ears of rye, there are to be found grains composed of rye and ergot, the portion ergotted makes sometimes one half, and sometimes only one third of the grain, and is that part within the husk, while that part which is rye is most distant from the ear. These grains, if planted, will not vegetate, the germ being destroyed. Winter and spring rye are, as far as has been observed, equally liable to this disease.

Much time and attention have been devoted by different naturalists, to ascertain the cause of this production in rye. Some, from the circumstance that there is more produced in rainy seasons, and in wet grounds, have attributed its formation to the moisture of the air and the earth; others believe it to proceed from the grains having been pierced by insects; while others have regarded it as a *mole*, occasioned by a faulty fecundation. This last opinion is more probably correct, for nothing has been found to contribute so much to its production, if the soil

be moist, as a storm of rain falling upon the grain when in bloom.

THERE will always be more of it found on the borders of fields, than in other parts, where the soil is less beaten and more mellow. The humidity being equal, those fields are most infested with it, which have been newly turned up.

THE soil and climate of Sologne are so peculiarly adapted to the growth of this substance, that it is said to produce more of it, than all France beside; for, in some years, not less than one fourth of all the grain, raised in this province, is ergotted. In this district and its vicinity, there has, at different periods, prevailed among the peasants, a very malignant and mortal disease, which is characterized by a dry gangrene in some one of the extremities, sometimes in all of them, which has been generally ascribed to their living upon bread, made of the ergotted rye.* This bread, M. Dodart informs us, does not differ, in regard to taste, from ordinary bread; it is more particularly pernicious when new; but its effects are not observed until it has been eaten a considerable time. According to the observation of M. Noel, the ergot loses its deleterious qualities altogether, after having been kept a few months in sheaf: and writers all agree in this, that the disease it is supposed to

* For a particular account of this disease, and the method adopted for its cure, vide Duncan's Med. Com. Vol. ix. p. 78.

induce is prevalent only at the conclusion of harvest, and ceases entirely before the commencement of winter.

Besides this spontaneous gangrene of the limbs, Hoffman and other writers have attributed also to its use, another species of disease, which prevailed at different periods, in various parts of Europe, attended by convulsions and spasmodic affections. But these are now generally considered as originating from other causes.

In France, many experiments have been made on animals, to prove its malignant effects, and numerous communications have been published, showing its noxious properties; but I believe it has never been considered, by any of these writers, as capable of subserving any medicinal or other useful purpose.

Some few empirics, however, it is said, have long known that the ergot would expedite lingering labour. But these ignorant pretenders bestow on their nostrums encomiums so extravagant, and their impositions on the credulity of the public are so numerous and frequent, that no credit whatever can be attached to their recommendations. Most of their mighty secrets, when disclosed, prove altogether inert; or at best very incompetent to effect the purposes for which they are intended. Their powder, to promote delivery, was consequently de-

rided, and was thought by the faculty to be unworthy of serious attention or regard.

The first information the public received, from a source entitled to credence, that this production was, in reality, endued with such an unexampled property, was through the medium of the New York Medical Repository,* by a letter from Dr. J. Stearns to Dr. Akerly. In this communication, Dr. Stearns designates it by the appellation of *pulvis parturiens.*

Very soon after this publication, I procured a sufficient quantity for experiment, and have since frequently used it. With very few exceptions, its uniform effect is to stimulate the uterus to increased action, when administered in parturition. But I cannot say with Dr. Stearns, "I have never been disappointed in my expectations of its effects;" for I met this disappointment in the very first case in which I prescribed it. In that case, a neighbouring physician was attending the patient, the travail had progressed slowly, but in a regular manner, until the head of the fœtus was detruded so low into the pelvis, that the ear was perceptible to the touch, when the pains subsided, and had entirely ceased, some hours before I was summoned. One drachm was administered, in the form of decoction, at three separate doses, but without

* Vol. ii. p. 308.

producing any effect, when the delivery was accomplished by the aid of the *forceps.*

Two similar cases have since occurred, in which the pains had totally ceased, toward the termination of labour, and in which parturient efforts could not be revived, by any quantity I thought it prudent to administer. In one of these last, the patient took the decoction of more than two drachms in divided doses.

In four other patients, I had reason to doubt whether the pains were increased by its use, either in frequency or strength; but one dose only was given to either of them, for the irritable state of the stomach prevented its being repeated.

In every other instance, without exception, the effects of this prescription have been such as fully to demonstrate its powers "*ad partum accelerandum.*" The pains produced by it, when a full dose is given, are very peculiarly forcing, and the contractile effort of the uterus continues to that degree, that the fœtus is not suffered to retreat, but remains firmly retained where the last exacerbation of pain left it, until it recurs again. This incessant action will continue, if the delivery is not effected, for an hour or more, and when it subsides, the medicine, again given, will reproduce the same effects.

The frequency and violence of the uterine efforts, induced by the ergot, are not more extraordinary, than is its almost instantaneous ope-

ration. In twenty cases, I carefully noticed the precise time it required, to produce its customary effects. In two of them, the increased strength of the pains, and the continued action, commenced in seven minutes from the time the decoction was taken; in one case it was eight minutes, in seven it was ten, in three, eleven, and in three others it was fifteen minutes. In the four remaining cases, there was no apparent operation until twenty minutes had expired. In other cases, the time was not particularly noticed, but as the twenty I have given were nearly in succession, it is probable they will show the proportion, as accurately, as if the time in all had been precisely ascertained.

From this account of the manner in which the ergot usually operates, it will be readily conceived, by those who have not witnessed its effects, that it is a powerful agent, which requires prudent direction, but when properly applied, will be highly useful, many times, to shorten a process, which, unaided, would prove extremely tedious and troublesome.

Before I had acquired sufficient experience of its effects, I imprudently used it once or twice when the pains were tardy and feeble, even in first labour, before the orifice of the uterus was much relaxed or dilated; it having been recommended to "produce all the beneficial effects of bleeding without inducing the debility." But it does *not* usually prove relaxing to the rigid

fibre; its operation, therefore, subjected the patients to much unnecessary suffering. In one instance, no perceptible progress was made, by the continuance of forcible uterine efforts, during the space of an hour.

It is therefore important, even if the pains are feeble and unfrequent, to delay giving this stimulating drug, until considerable dilatation has taken place; to leave the business in its early stages to the slow and regular process of nature; and by the respite thus gained by the intervals from pain, preserve the strength and resolution of the patient for later and more painful efforts.

But if the labour should be long protracted, from the irregular action of the uterus, or the rigidity of the muscular fibres, these obstacles should be first removed by venesection; after which the ergot may be usefully employed, and its operation will be found mild and efficacious. But whenever recourse is had to venesection, the depletion should be copious, and the blood suddenly drawn from a large orifice, for no possible advantage will be gained by this operation, on a plethoric subject, if the quantity taken be less than twenty ounces; and I have repeatedly taken thirty, before the necessary end could be accomplished.

I have never administered ergot in substance, but always in the form of decoction, in the proportion of half a drachm to four ounces of water, of which one third is taken at a time; if the pains

are not sufficiently augmented in twenty minutes, then half the remainder is given; but a second dose is rarely required.

It will probably be found more beneficial in many cases to diminish the quantity to one large table spoonful, which, taken every ten minutes, will have the effect to increase the vigour of the pains, without producing such excessive and constant action, as is usual when the full dose is administered. I have lately directed it in this manner, and have been so much gratified with its more temperate, though efficient action, that I shall hereafter prefer the smaller to the larger quantity.

It has been suggested, by a writer in the New England Journal of Medicine and Surgery, that the death of the infant is a more frequent occurrence, in cases in which the ergot has been employed, than where its agency has not been used. If this is indeed the case, it forms at once an insuperable objection to its use, except in cases where its safety is well defined; and the subject certainly demands deliberate attention and serious inquiry. For myself, it is, I conceive, rather questionable, whether more injury would result to the child "from unceasing pressure for several minutes, and occasionally for half an hour or more" than from a much more tedious process, in which the pressure is reiterated, and the head permitted to retreat after each successive effort. But, in a matter of such importance,

we ought not to be governed by conjecture; but should adopt or reject it, as its beneficial or destructive operation is tested by experiment. My own experience has been such, as to persuade me, that the above suggestion is unfounded. It is true that in twenty-two cases of first labour, in which this medicine had any effect, I lost four children, and in thirty-five where it was given to women, who had been previously delivered, I have lost one. But all these deaths were attended with such circumstances, as fully to exculpate the ergot from any agency in the event. And when it is recollected that this medicine is not used, except in cases that are long protracted, or are likely to prove tedious and troublesome, it will not be thought, I conclude, that this unfortunate event happened more frequently, or in greater proportion to the whole number of cases, than might reasonably have been expected, had this medicine not been prescribed.—But exclusive of any injurious effects, which may result to the infant, the ergot requires much more caution with respect to its use, in cases of first labour, than in others: for owing to the usual tension and rigidity of the parts, the protruding progress will not be accelerated, in any reasonable proportion to the additional pain and suffering it produces. It is also too active and powerful an agent, to be safely directed by an ignorant or unexperienced accoucheur; and before dismissing the subject, I most cordially

join in cautioning those, who have not been in the practice of using it, and witnessing its operations, to be wary how they employ its agency, until the muscular fibre is properly relaxed, and the *os uteri* considerably dilated. This caution is also more especially necessary, if they are not positively certain that the presentation is natural, as well as " that there are no preternatural obstructions, to prevent delivery ; as the violent pain, and almost incessant action, which it frequently induces in the uterus, precludes the possibility of turning" the fœtus.

Dr. Beekman is said to have succeeded in a case of amenorrhœa, by giving one drachm of the ergot in decoction. In consequence of this recommendation, I tried its effects in one case of partial obstruction, by giving it, first in a dose of one drachm ; at the next period the same patient took two drachms, but without the desired effect. And from analogy, I should conclude, that it was unadapted to this complaint. The tendency of its operation is, I conceive, to constringe the uterine fibres, and lessen the caliber of its blood vessels ; for when given to parturient patients, there has been no instance, within my knowledge, of undue hæmorrhage after delivery, although several, who have taken it, had been previously accustomed to profuse discharges. The lochia also, have occasionally been so much diminished, after its use, as to excite apprehension for the event. In two cases,

this discharge entirely ceased, on the second or third day after delivery, and did not reappear during the month; but no puerperal complaint was induced, nor was their recovery delayed by this incident.

The uniform operation of the ergot to restrain uterine hæmorrhage, has been noticed by other physicians. It has in consequence, frequently been prescribed, a little previous to the birth of the child, or immediately after, to patients that have been accustomed to flow immoderately, at such times, and it has always proved an effectual preventive.

This singular property of the ergot, to diminish the enlarged cavity of the uterus, is never more strikingly exemplified, than when its agency is employed to restrain those floodings, which sometimes appear in the early months of pregnancy, when the action of gestation has ceased, and abortion must follow. In such case, it speedily excites in the uterus, such energetic action, that its contents are soon expelled, and the hæmorrhage ceases.

In order to determine what operation it might have, on a healthy male subject, the decoction of one drachm has been taken at a dose; but it produced neither nausea nor other perceptible effect. After a few days, the same person took a like quantity, which proved equally inert: neither did the larger quantity of two drachms, at a few doses, but all within the space of two

hours, occasion nausea, vomiting, or pain in the female, to whom it was prescribed for deficient catamenia.

Its operative powers, therefore, appear wholly confined to the uterine fibres, when lengthened from an enlargement of that viscus. In such case it speedily excites, in them, strong contractile action, and so long as the stimulating effect of the medicine lasts, this action is unceasing. The uterus is thus made to compress closely, upon any substance whatever within its cavity, and this resistance to its further collapsing, will cause violent pain in this organ; but if it find no such resistance, the contractile action progresses without any uneasy sensations. The healthy, unimpregnated uterus, having nothing within its cavity, will therefore not be affected by the ergot; neither is it calculated to restrain menorrhagia, proceeding from increased arterial action; as the size of the uterus, in such cases, is nearly at its minimum.

Until we clearly understand the reason, why some medicines possess a greater affinity to one part of the system, or to one organ, than to another, it will be difficult to explain the *modus operandi* of the ergot. It is, as has been already observed, but a short time since it first attracted the notice of physicians, as being subservient to any useful purpose in medicine; and I have not yet discovered that it possesses any other pro-

perties, than such as I have mentioned. Like all other active and valuable medicines, when first made known to the public, it requires a long series of judicious and attentive experiments, fully to develope its character, its qualities, and the precise manner in which it may affect different parts of the human system. Like them, while its use is beneficial, its abuse is destructive. A cautious direction of its powers cannot, therefore, be too strongly recommended. If properly administered, it must be esteemed an important and valuable acquisition to our *materia medica*, and is unquestionably destined to hold a high rank, among the means, which kind nature has provided, for relieving the sufferings of her children.

THE END.

ARTICLE IV.

A

DISSERTATION

ON

PHLEGMASIA DOLENS.

By RICHARD HAZELTINE, M.D. A.M. M.M.S.

Read at the annual meeting, June 5th. 1816.

OBSERVATIONS ON PHLEGMASIA DOLENS.

The Earl of Chesterfield, in one of his letters to his son, as a motive to enterprise, activity and diligence, tells him it ought at least to be the aim of every rational being either to do something worthy to be written, or to write something that may deserve to be read.* If the correctness of this opinion, as it respects the obligation of men in general to become candidates for fame, should be denied; its truth, probably, will not be contested, when the question relates to the duty of men in any of the learned pro-

* A sentiment, however, for which he was indebted to a passage in the writings of the younger Pliny.

fessions. Without, however, indulging so much self-complacency, as to flatter myself that I shall even have attained either object to which the noble Lord would urge every man to aspire; animated by a motive so laudable, and obedient to a call of the counsellors of this society, I have prepared for the present anniversary exercise, and proceed to read, *Observations on that singular affection of the lower extremities especially incident to puerperal women, and described in medical books, under the unrelated names of* OEDEMA LACTEUM, PHLEGMASIA DOLENS, HYSTERALGIA A SPARGANOSI, &c. &c.

I shall not pause to inquire into the antiquity of this disease, nor at how early a period it first engaged the attention of physicians; it is sufficient that it frequently occurs in our own times, and in this part of the world; that it is, though commonly mild and easily cured, occasionally so severe as to require the best directed efforts of art to assuage its violence; neither will a formal description of the disease be attempted; since that has been already amply given by others. I shall, therefore, offer only such pathological remarks as may tend to bring into view, some of the leading circumstances of the disease: and then exhibit what I conceive to be the best method of treatment, illustrated by the history of a few apposite cases.

In entering on the discussion of the subject before us, it cannot be deemed irrelative to in-

quire, why this disease has occurred much more frequently in the practice of some physicians than in that of others? In prosecuting this inquiry it is proper to observe, that there has been a remarkable difference in this respect in different places; as a reference to a few facts will strikingly evince. Mr. Trye, in his essay on this disease, has given the history of nine cases only as his own; but has not stated the number of cases which he had seen, nor the extent of his practice in obstetrics. Mr. White informs us that out of 1897 women delivered at the Westminster General Dispensary, five only were attacked with this disease; and of 8000 women delivered at the Manchester lying-in-hospital, and their own houses, no more than four were seized with it. Dr. Thomas states that during a practice of thirty years, a solitary case had fallen under his care.* Mr. Burns of Glasgow, without specifying the number of cases which he had seen, or speaking of its comparative frequency, says, "it is by no means uncommon;" and adds, "is exceedingly troublesome."† The late Dr. Wyer, of this society, in a communication on this subject,‡ says that he has "met with only five cases in nine hundred and eighty-

* Modern practice of physic; Miller's edition, p. 611, New-York, 1811.

† "Obstetrical works," New-York edition, p. 199.

‡ Medical communications to the Massachusetts Medical Society, vol. 1, p. 3, series 3.

nine women," whom he had delivered; and another gentleman of this society informs us in a communication on the same subject;* that "in the course of twenty-eight years' practice," he recollects "to have seen seven or eight cases" of this disease; but does not name the number of parturitions in which he has been concerned. I am not able to speak with much precision respecting the comparative frequency of this disease in the County of York, where I have resided more than twenty years; but I am possessed of facts which warrant me to believe that it has occurred more frequently there within that space of time, than any where else among the same number of inhabitants.

†[Educated in a part of the country where the state of society was very propitious for the introduction of a young man *in rerum puerperarum exercitationem;* and having since resided in places where, if not already in the hands of accoucheurs, it speedily became a part of their routine of duties; the writer has been concerned in the business twenty-five years; and within that space of time, has presided at the birth of 800 children. Phlegmasia dolens, though occasionally occurring, never excited any particular in-

* Medical communication to the Massachusetts Medical Society, vol. 2, article 1.

† Whatever here or hereafter occurs included in brackets, was omitted when this discourse was read.

terest till the year 1804; the writer is, therefore, unable to say precisely, what number of cases has fallen under his inspection; but he recollects perfectly to have had the care of seven, and to have been somewhat acquainted with the circumstances of two others, within the fifteen years; and the number of parturitions which he has attended within the same time, amounts to 584. The total silence on this subject of all the medical books which he met with during his pupilage, and the limited opportunity which he then had of perusing Motherby's Medical Dictionary, which alone contained any, to him accessible, account of the disease, afforded him little or no advantages as it respected the particular method of treatment; of course, he had treated all the cases which came under his care previously to the year 1804, altogether on what Mr. Burns calls "general principles;"* and in this way his practice had been uniformly successful; but in that year a case occurred of singular severity and obstinacy, and accompanied with circumstances calculated to rouse all his feelings, and to call into exercise all his powers of investigation and reflection. The long continuance of this case engaged his attention for several months; nay, his patient having already suffered extremely, and still experiencing not a little inconvenience from

* "Obstetrical works," New-York edition, p. 200.

the chronic effects of the disease; and being anxious to treat it with more satisfaction to himself, and more to the benefit of his patients in future, should other cases ever come under his care; he prosecuted his inquiries respecting it on every hand; but obtained no valuable information till in the following spring of 1805; when he procured Mr. Trye's Essay. From this Essay, which the writer acknowledges afforded him much important instruction, he soon discovered that there was still room for further investigation and improvement. He has never lost sight of the subject; he has perused new books; he has attended to new cases of the disease, with unwearied diligence and care: and if he have a claim to the credit of advancing any thing new or useful respecting the nature or treatment of the disease, it is owing to the interest which the case alluded to, excited.]

THE question now recurs, to what cause shall we attribute this difference in the reports of different physicians, respecting the comparative frequency of this disease in different places? To me it appears it cannot be ascribed merely to the difference in the number of obstetric cases which have fallen into the hands of different practitioners, nor to any deficiency of professional knowledge or care in these practitioners, but it is believed that the cause of this difference must be sought for, and will be found, in some other circumstances connected with the

pregnant, parturient, and puerperal states; and that in ascertaining these circumstances, we shall develope some of the causes of the disease.—What are these circumstances?

1. It is believed that this disease has most rarely occurred in those places where the management of female complaints, peculiar to the pregnant and puerperal states, has been exclusively under the direction of well-informed accoucheurs and midwives.

2. This disease appears to have occurred most frequently in those places where midwives only, and those possessed of inadequate practical information, have been consulted in the diseases of women concerned in the business of procreation; or at least in those places, where, if accoucheurs have begun to be employed in parturition, their assistance has not often been solicited on account of the diseased conditions of the system incident to the pregnant and puerperal states; and where, of course, not much has ever been done by way of prevention.

3. It appears that this disease is most frequent in those places where the practice of midwifery is passing from the hands of female, into the hands of male, practitioners; and in new settlements, where pregnant and puerperal women are more exposed to the causes of inflammation, and where, from the want of proper medical aid, this disposition is not obviated by a suitable regimen, blood-letting and other evacuations.

4. A circumstance of the system itself, which almost always attends the pregnant and puerperal states, and is supposed to constitute the predisposing cause of this disease, is a phlogistic diathesis, by which, on the application of the usual exciting causes, the disease is readily induced at any time and in any place, independently of the other circumstances enumerated: hence the disease is so frequently preceded by parturition.

From these considerations it appears, that the circumstances which give occasion to a more frequent occurrence of this disease in some places than in others, the number of parturitions being the same, are, a more powerful operation of the remote causes of inflammation, and the want or neglect of the means suited to obviate this disposition.

Though a particular description of this disease is purposely omitted, it will comport with the objects of this exercise, to introduce the following brief sketch of its pathognomonic symptoms, from Rees' Cyclopædia.*

"The symptoms vary a little in different cases, apparently according as the uterus itself or its particular appendages are disordered. In general the patient complains of pains in the loins, extending round the margin of the pelvis, to the groin, on one or both sides, and shooting down

* Vide Rees' Cyclopædia, *voce* Hysteralgia.

the thigh to the knee, or, in more severe cases even to the foot. Sometimes the pain is more strictly referred to the uterus itself, or its neck, and the loins are scarcely affected; and sometimes it is fixed, in one side, above the ilium, as if seated in the ovarium. In one case we have seen the disease confined apparently to the ovarium and ligaments of one side, in which there was great soreness of the part, where the round ligament passes to the pubes. The stomach is frequently disordered by sympathy, and the patient complains of nausea, flatulence and other symptoms of indigestion; and, occasionally some degree of febrile action attends the complaint."

In the foregoing sketch, this disease is represented to be, as it undoubtedly is, originally, a local affection, and in its most simple form; but it is almost always accompanied with circumstances, which, if not essential to its character, are so often present, as to hold a conspicuous place in the diagnosis, and require particular attention in the method of treatment. Phlogistic diathesis, and general inflammatory action, if not present at the commencement, are commonly induced by the local inflammation: the parts in pain are generally tumefied; other sympathetic affections are observable beside a disordered stomach; there is in most cases, some degree of the "*animus, nec sponte, varius et mutabilis*"*

* Cullen's Synopsis Nosologio Methodico; genus 63; Hysteria.

of hysteria; which probably led Dr. Sydenham to class this complaint among "hysteric diseases:"* the morbid action of the heart and arteries is also, for the most part, of a sympathetic nature; hence, the fever is, strictly speaking, a sensitive or hectic fever. I know it has been called by very respectable authority, an "irritative" fever;† but I am persuaded it was an inadvertence. Some may think it mere trifling to bestow words on this point; but to me it seems of some importance to determine whether the fever in this disease be "irritative" or sensitive; idiopathic or symptomatic. In my opinion it is a sensitive or hectic fever which generally attends, at least, after a few days; not only from considering the character of the fever itself; but because it is consequent to a primary local affection; and, I am happy to find myself supported in this opinion by Mr. Burns.‡ It will not be denied, however, that the fever, during the first stage of the disease and previously to evacuations, is often a "febris sensitiva irritata," or a phlegmasia; for the writer is clearly of the opinion that it is such; and he is, therefore, disposed to maintain, contrary to the opinion of some, that the disease is often of an inflammatory nature. Dr. Thomas asserts that "no inflam-

* Epistle from Dr. Sydenham to Dr. Cole, § 69.

† Medical Com. to the Massa. Med. Soc. Vol. 2. p. 2.—New England Journal, Vol. 3. p. 328.

‡ Burns' "Obstetrical Works," New York edition, page 199.

matory tendency prevails in the system in this complaint:"* a declaration that excites *no* surprise, when it is considered that it comes from one who acknowledges at the same time, that he had never seen more than one case of it. Whatever may have been the character of the disease in Europe and other places, all the cases of it which I have seen, with no more than one exception, have been attended with circumstances of inflammation; at least at the commencement.

THERE are sometimes some other circumstances of complication, which, as being less constant and important, will meet with no attention on the present occasion. I shall, however, briefly animadvert on a few other opinions relating to the nature and causes of this disease, which do not correspond with my own; and from which I am constrained to dissent.

1. THE late Dr. Denman, of whose character and writings I entertain a most exalted opinion, and whose description of this disease I consider for the most part very judicious; speaks of a certain "paleness" of the whole surface of the body, and of "every vein seeming to be scantily supplied with blood;"† but according to my observation, the surface is generally suffused with redness, at least it is so in the face, and in the early stages of the disease, and the veins

* Modern Practice of Physic, Miller's edit. page 613.

† Introduction to the Practice of Midwifery, Chap. xix, sect. 3.

are turgid: this latter circumstance is obvious, even though paleness at the same time pervade the surface.

2. This disease has been represented by some, as being attended with circumstances of general weakness; and it has been said that the pulse is "generally feeble;" but in most of the cases which I have seen, circumstances have been such as to require blood-letting and other antiphlogistic measures; especially in the early periods of the disease.

3. While it is sufficiently evident, and generally admitted among writers, that the proximate cause of this disease consists in an inflamed state of the internal and external iliac glands; it is not, in the writer's opinion, so clear, "that the absorption of vitiated matter from the uterus," or any other part, is the cause of this inflammation; for beside that the disease has been often known to occur when no circumstance indicating a depraved or vitiated secretion from the uterus, had preceded; the writer believes it has affected the male sex; or if it have not, it certainly has occurred in females, unconnected with parturition either immediately or remotely; as will be more particularly stated under the next head. This supposition of the absorption of vitiated matter being the cause of the inflammation of the iliac glands, is still more exceptionable, when it is considered that this vitiated matter is also supposed to act in the

same manner as absorbed poisons, when introduced into the system by inoculation. It is deemed of some importance to invalidate this supposition, which Dr. Denman espouses with considerable confidence; inasmuch as it does, perhaps, consistently enough with its truth, lead merely to a palliative method of treatment. Dr. Denman's language is, "having formed this opinion of the cause of this disease, and reasoning by analogy of its effects, in the method of the treatment, without aiming to cure the disease in the first instance, I take the symptoms for my guide, and endeavour to relieve these by all the means in my power." Again he says, "if my opinion of the cause of the disease be just, the hasty dispersion of the swelling of the glands, if it could be effected, though it might lessen or wholly remove the swelling of the limb, would ultimately prove a great disadvantage, by allowing the absorbed *virus* to escape, and thus pervading the whole body, a disease primarily local would become a general one of the most dangerous kind." Accordingly, under the influence of a false analogy and an erroneous train of reasoning, Dr. Denman advises a method of treatment which is merely palliative; and to say the least of it, very ill adapted to the nature and circumstances of the disease as it has uniformly fallen under the inspection of the writer, or of his brethren with whom he has conversed upon the subject. The writer recollects to have seen

no case that required, or would admit the patient to be "supported by cordial medicines," nor "by a liberal use of wine," nor of "opiates" (which are the medicines recommended by Dr. Denman,) till after blood-letting or some other evacuations, or both: neither is the Doctor's method of treating the limb much more to be imitated; and well may he notify his reader, that "not much permanent benefit" is to be expected from it.*

4. As this disease has commonly been preceded by parturition, it has been ascribed to a metastasis of the milk; and hence several of its names which are significant of this circumstance:† but that this opinion is unfounded, is evident from the consideration that if the disease have never occurred in the male sex, which the writer believes is not the fact; it has affected females whose circumstances were in every respect, widely remote from pregnancy or parturition; and it has been known to succeed abortions, where the secretion of milk did not supervene. Mr. Trye says expressly, that this affection "is not peculiar to women who have suffered parturition;" and speaks of a case in which it came on nearly in the manner described by Mr. White, "in a person who had suffer-

* Introduction to the practice of Midwifery, chap. xix, sect. 3. pp. 279, 280. New-York edition, 1802.

† As, *Depot de lait*:—*Oedema lacteum*:—*Hysteralgia et Ischias à sparganosi*, &c. &c.

ed greatly from a retention of urine and inflammation of the bladder."* The late Dr. Ferriar is said to have entertained a similar opinion. Dr. Thomas mentions a case which he had under his care when he wrote, "in an aged woman, and of course unconnected with parturition."† The writer himself has known one well marked instance of the disease succeed an abortion after a pregnancy of only ten weeks: he had under his care, last February and March, a young lady aged eighteen, in whom the disease appeared wholly to proceed from sympathy with, or continuous inflammation from, hæmorrhoides cæcæ: the circumstances of this case will be briefly related in the sequel.—Case 5.

My ideas of the pathology of this disease are summarily comprised in the following paragraph:

In certain persons labouring under phlogistic diathesis, certain causes produce an inflamed state of the iliac glands; this may be owing merely to inflammation communicated from the rectum, the uterus, and its appendages, the prostrate gland, the vesica urinaria, or other neighbouring parts; or it may proceed from the direct impression of some cause on the

* Essay on the swelling of the lower extremities, &c. p. 45, London edition, 1792.

† Modern practice of physic: Miller's edition, p. 612; note at the bottom of the page.

glands themselves, but to whatever it may be owing, it gives occasion to an obstruction of the lymph returning from the lower extremities, and thereby to all the circumstances of the limb peculiar to the disease; and to all the sympathetic and chronic effects which constitute the other phenomena of it.

Though I have hitherto spoken only of the iliac glands as being the seat of this affection; facts are not wanting to prove that the inguinal and femoral glands also, if not equally, are often, and perhaps commonly, as much concerned as the former; but this will not impair the correctness of the pathology of the disease suggested, nor essentially vary the method of treatment.

It is obvious that I consider this disease to be always seated originally, in and about the pelvis: it is deemed necessary to make this remark as I go along; because it has been supposed by some, that the diseased condition of the inguinal and iliac glands, may be owing to inflammation communicated to them from inflammation primarily begun in some part of the extremity.

[It may be asked; if simple inflammation of the inguinal glands in certain conditions of the system, give occasion to phlegmasia dolens, why does not bubo, which is an inflamed state of the same glands, produce the same effects?—I conceive it is not difficult to give a satisfactory answer.

ANOTHER question may be proposed to those who advocate the opinion of the absorption of vitiated matter being the cause of this disease, viz. If the inflammation of the lymphatic glands which gives occasion to phlegmasia dolens be owing to the absorption of vitiated matter from the uterus and vagina; why does not the inflammation of the same glands in bubo, which proceeds from the absorption of the matter of a virulent gonorrhæa or chancre, give occasion to the same?

MANY such questions might be proposed; but it is not the business of this exercise to state or answer them.]

IF the scheme of pathology which I have introduced be correct, the whole treatment of this disease will turn on the accomplishment of the three following indications, viz.

FIRST. *To take off the phlogistic diathesis of the system, and resolve local inflammation.*

SECOND. *To subdue sympathetic action, arterial and nervous.*

THIRD. *To remove the chronic effect of the disease.*

To point out the means of fulfilling the first indication, it will be much to the purpose to introduce the following paragraphs from Mr. Trye's Essay.

"WHEN subsequent to delivery we meet with a patient complaining of a soreness in one of the iliac regions, and upon examination we find

a great fulness and hardness in that region, accompanied with increased uneasiness in turning of the body, and in drawing up the leg and thigh on that side, fever having preceded, or being still present, we may for a short time try the effects of warm fomentation of the belly; and in case it be not already sufficiently open, administer a laxative clyster. If ease and a removal of the fulness and soreness in the flank be not by these means quickly obtained, we apply to the most sore part of the iliac region six or seven leeches, or even a greater number, if the patient's condition will admit the loss of much blood. As soon as the leeches are taken away, we administer a mixture of Ipecacuanha and tartar emetic, given in such quantity as to produce full vomiting. If the mixture have not the additional effect of procuring a few stools, it should be followed by a gentle cathartic.

"As soon as the bleeding occasioned by the leeches has ceased, we lay a blister plaster upon the pained part.

"After the use of these means the pain and soreness in the flank will abate, and the swelling subside, and in a short time be entirely removed. But if any pain or hardness remain after the discharge from the blister has ceased, let leeches be again applied, and the consequent bleeding be succeeded by a second blister. In the trials, which I have made of this treatment,

the complaint has been completely removed before the healing of the second vesication.

"I have not had occasion to say any thing about the swelling of the leg and thigh, because this swelling has subsided fast enough as the soreness and fulness in the belly went off. However, it may be useful to wrap up the leg in bathed cabbage leaves, and, perhaps, to make a few punctures with a lancet into the cellular substance of its integuments."*

This method of treatment presupposes not only a moderate form, but an early period of this disease; and under these circumstances it is believed to be perfectly adequate to a cure. It is particularly well adapted to the circumstances delineated in the quotation heretofore made from Rees' Cyclopædia: and I am fully persuaded that by far the greater proportion of cases of this disease, if taken in season and treated according to the foregoing method, would yield in a few days. But we are not always so fortunate as to be called when circumstances are so favourable: the disease, perhaps, has already subsisted for some time, and become complicated. At first merely local, and unaccompanied with much phlogistic diathesis, general inflammation, or sympathetic action; from the want of seasonable and proper medical aid, it may

* Essay on the swelling of the lower extremities, &c. pp. 12, 13, and 14. London edition, 1792.

have assumed a serious aspect. A high degree of inflammatory action, and of nervous irritation may have supervened; and a diseased condition of the system so complicated, may be succeeded by consequences which will still require the unremitted assiduity of the skilful physician. Under such circumstances it will be necessary to do something more than what is pointed out in the quotation from Mr. Trye.

If there be any considerable degree of general inflammatory action, it will be adviseable to TAKE BLOOD from the arm. It is believed there are but few cases of this disease in country places, especially in new settlements, that would not be relieved by this evacuation. The circumstances which in this disease indicate bloodletting, are, thirst, furred tongue, a hot, dry, skin; turgid superficial veins, even though they appear so only on the back of the hands, while paleness pervades the surface elsewhere; severe pain, and a tense or hard pulse, even though it be at the same time small. It cannot be too urgently inculcated, especially on the younger part of the profession, that there are frequent cases of disease of a febrile nature, attended with a small pulse, which is at the same time hard or tense, in which no expedient is so salutary as the detraction of a few ounces of blood, or the operation of an emetic, or a cathartic; and in which wine, opium, bark, and other stimulants and tonics, would produce very unhappy effects. In-

deed it is often necessary in the treatment of diseases, to take blood, when the state of the pulse seems absolutely to contra-indicate the evacuation. In such cases a very frequent circumstance by which I am governed in deciding on the propriety of the operation, is a turgidity of the veins on the back of the hands, the arms being at the same time, free from compression.* In considering the case related by Dr. Wyer, in the communication already referred to, in which he was so highly interested; who can doubt the great advantages that would have resulted from bloodletting, when it is stated that "the pulse was seldom below an hundred and twenty, and very hard?" And yet we do not read that the operation was resorted to.—Cases will be stated in the sequel, which will evince the utility of bloodletting and other evacuations in the treatment of this disease.

With a view to accomplish the same purpose, viz. to take off inflammatory action, general and local; it may be necessary to repeat the emetic and cathartic, and, perhaps, more than once;

* It is to be noted, however, that a turgidity of the veins on the back of the hands, accompanied with a small pulse, is often owing to a torpid state of the chylopoietic viscera, and to collections of fecal matter in the alimentary canal. In such cases emetics and cathartics are to be employed previously to bloodletting; by which, perhaps, the latter will be rendered unnecessary. But a turgidity of the veins on the back of the hands accompanied with a small pulse without turgidity of vessels in any other part, are frequent signs of plethora; and particularly indicate bloodletting.

especially the latter. It is well known to practitioners that these medicines are powerful means of diminishing arterial action, and of resolving local inflammation when situated in parts remote from the seat of their immediate action. This they probably effect, by abstracting a portion of the stimulating contents of the vessels, both serous and lymphatic; and by exciting increased action in the whole system of absorbents.

ANTIMONIAL, MERCURIAL, and CAMPHORATED SUDORIFICS in small doses, and frequently repeated, are to be esteemed useful auxiliaries to the preceding remedies.

As it is not in the power of many country practitioners to avail themselves of the use of leeches in the treatment of this disease; the next expedient to which we may resort, with a particular view to the local affection, after fomentation, is BLISTERING, as recommended by Mr. Trye. Blistering in this disease is one of the most useful prescriptions. As soon as it is found that fomentation and the remedies heretofore recommended will probably prove ineffectual in arresting the progress of the disease; or, if it have already become severe before the physician is called; in addition to what has been recommended, without consuming time in the employment of fomentations, an epispastic is immediately to be applied to the part *most in pain*, and to every other part in succession, as the pain may shift or increase: and, if the extremity be al-

ready in *any degree tumefied*, (without regarding the epispastic,) it is to be immediately enveloped in a spiral bandage, at least from the toes to the knee; but if the tumefaction extend above the knee, the bandage is to be continued to the nates.

If blistering have ever proved useless or injurious in this disease, it has been, probably, at an advanced period of it; but even then it may be employed with great advantage, if a bandage be used at the same time.

I know of no writer who has recommended the employment of the bandage in this disease, till its use has become necessary to remove the chronic effects of it; but it is of the *first utility*, applied as soon as *any tumefaction* commences. The reasonableness of this expedient will at once be admitted, when it is considered that a very great share of the distress arising from the condition of the extremity is altogether owing to the lymphatic distention of the soft parts.

The early employment of the bandage in this disease, was once objected to by an eminent practitioner to whom it was proposed; from the apprehension that the inflamed state of the limb would not admit of it; but this objection is altogether unfounded; for the writer has repeatedly applied it when the limb was highly inflamed; and it has invariably produced an immediate alleviation of the pain and distress.

THE early use of the bandage prevents, in some measure, the sympathetic effects of the disease; but more especially, the enlargement, debility, and consequent awkwardness of the limb, spoken of by some writers, as remaining for life or for a long time; and thereby subjecting persons who have been unfortunately visited with this disease, to great inconvenience: it also prevents suppurations; which is an important object in the treatment. The writer has, indeed, known persons who have for a long time been afflicted with the consequences just named; but they were those to whom the bandage had never been recommended.

THIS defence of the early use of the bandage in this disease, is not speculative; it is founded on facts which have repeatedly occurred under the writer's observation; and he, therefore, feels justified in speaking with some confidence on the subject: but, it is to be distinctly understood, that the foregoing remarks relate only to a spiral bandage *uniformly* applied.

IT is intended to say little more of EMBROCATIONS, LINIMENTS, UNGUENTS, CATAPLASMS, CAMPHORATED OIL, &c. &c. than merely to condemn their employment in this disease. Who ever knew them do any good? In the writer's opinion they always do harm, by promoting effusion, distention and pain. From this condemnatory sentence, however, perhaps, ought to be exempted, the UNGUENTUM HYDRARGYRI, which,

as possibly promoting the action of the absorbents, may prove beneficial, if the surface be anointed with it every morning previously to the reapplication of the bandage; but the use of the unguent should by no means supersede the employment of the bandage.—Can any one name a more powerful means "of rousing the action of the absorbents," as one writer on this disease expresses himself, than a well applied spiral bandage?*

I have never in any case of this disease, had recourse to puncturing the limb, as recommended by Mr. Trye; neither can I persuade myself that it is ever necessary or useful.

If the pain, tension, and soreness of the hypogastric, inguinal, or iliac regions, or a dysury which sometimes attends, should require any thing more to be done than what has already been suggested, it will be a frequent use of mild, cooling laxatives and enemas, together with the application of cloths moderately wet with tepid vinegar and water; and, perhaps, further vesication.

The intention of this indication will be promoted by a mild, thin diet; a recumbent posture; and as little motion as possible.

I have been more full and particular in pointing out the means of accomplishing this *first* indication; because if it be seasonably and success-

* New England Journal, &c. Vol. II, page 227,—top line.

fully executed, there will be little or no foundation for the *second* and *third.*

THE object of the *second* indication is,

To subdue sympathetic action, arterial and nervous.

EVERY practitioner who has seen severe cases of this disease, must have observed, that it is sometimes characterized by certain sympathetic affections which demand particular attention. Though the inflammatory action of the system may have been effectually taken off by the remedies heretofore recommended; yet that condition of the heart and arteries which Mr. Charles Bell calls, "the constitutional sympathy, with a continued low degree of local irritation,"* may still remain. This condition of the heart and arteries, though not of itself attended with any immediate danger, is gradually wasting the vital powers; and, perhaps, gives occasion to, or, at least, is accompanied with, other circumstances of a more serious nature, and ought to be removed. The principal of these circumstances are, beside all the inquietude which ordinarily attends a state of fever; extreme anxiety, pervigilium, inappetency, and that peculiar mobility of mind which has been considered of an hysterical nature. In fact, morbid excitability, nervous and vascular, is now to be combated.

* Operative Surgery; Hale and Hosmer's edition, Vol. I, page 20. Hartford, Con.

Under these circumstances OPIUM becomes not only admissible, but highly necessary and useful; especially if combined with CAMPHOR, IPECACUANHA, or an ANTIMONIAL: but while inflammatory action in any considerable degree remains, the writer is disposed to maintain that opium is altogether inadmissible. The inspissated juice of the CONIUM MACULATUM is not restricted in its use, like opium; and is, in these cases, an invaluable medicine. CASTOR, camphor, SPIRIT OF NITROUS ÆTHER, VALERIAN, and the fetid GUM RESINS, may be employed to much advantage, under these circumstances, as nervines, and antispasmodics; or, in other words, with a view to remove morbid excitability. To produce their full and proper effects, castor, camphor, and valerian, ought always to be given in substance, not only in this disease, but in others, in which they may be prescribed.—An infusion of the HUMULUS LUPULUS, or common hop, makes an excellent drink in these cases; and its tincture would undoubtedly serve a valuable purpose; but the writer has never employed it; nor the digitalis purpurea, having no confidence in it. Castor and camphor combined, and with, or without CALOMEL, NITRE, ipecacuanha, or opium, according to circumstances, is a composition of superior efficacy in answering this indication.

THE diet, now, may be more or less generous according to the degree of fever, and the state

of the stomach; but rest and a recumbent posture, are, for the most part, still to be enjoined.

It is the object of the *third* indication,

To remove the chronic effects of the disease.

These effects are, general debility, weakness, tumefaction, and immobility of the extremity: for the removal of all which, it is believed, nothing better can be proposed or pursued, than as much exercise, particularly riding in a carriage, as is practicable; a suitable diet, and the continued use of the spiral bandage. The cure, however, will in some cases, be greatly expedited, by a frequent employment of some gentle laxative: and it is, probably, with this view, that Mr. Burns recommends a "liberal use of a solution of cremor tartari." It is not to be doubted that frictions, together with cold bathing, general and topical, may be of great use in removing the chronic effects of this disease.

This performance terminates with the history of a few cases, illustrative of the efficacy of the method of treatment herein recommended.

[CASE I.

is one which I treated as I did all others which came under my care previously to the year 1804; and on what Mr. Burns calls "general principles."

April 15, 1803, I waited on Mrs. B. of an excellent constitution, and good health, in parturition of her first child. Nothing unusual oc-

curred in her travail; but her pains, with which she had been teased eighteen hours, under the superintendence of an uninformed, though prudent midwife, were now very short, frequent, distressing and unprofitable. I gave her two grains of crude opium, which diminished the morbid sensibility of the system; increased the uterine efforts; and rendered them more profitable, and effectual. In a few hours, she was comfortably brought to bed. I did not see her again till the sixth of May following; precisely three weeks from her confinement. I now learned that she had had but a poor getting up so far; and had been somewhat costive. She was in a mild febrile state, complaining of pain, tumefaction, &c. in the whole of one of her lower extremities; but the pain was most severe in the calf of the leg. To be brief; she was labouring under a moderate form of phlegmasia dolens. I directed an infusion of senna, salts [sulp. soda] and sem. cor. to be taken for a cathartic; and left liquid laudanum to be taken at night only, and in such doses as to procure rest; and laxative pills to obviate costiveness in future. The limb was treated with discutient applications, such as flannel, mullein or burdock leaves, wet with tepid vinegar and water, camphorated spirit, &c. &c.

May 10, I visited her again;—the febrile state had subsided; but the local affection was much the same. I now gave her an emetic of

ipecacuanha and emetic tartar, more from a regard to the condition of the limb, than the state of the stomach; to be succeeded by the use of an infusion of common bitters, such as gentian, orange-peel, chamomile flowers, &c.; and directed the continued employment of the laudanum and laxative pills.

THURSDAY, May 12th, I saw her again; and found her so well as to need no further medical attention.

I have waited on Mrs. B. in several parturitions since; but she has never experienced a recurrence of phlegmasia dolens. She has repeatedly told me that the extremity affected as above related had ever continued larger than the other; but gave her no great trouble.

I knew nothing of the use of blistering and bandaging in this disease when this case was under my care: and it is now related principally with a view to exhibit a specimen of my method of treating such cases previously to the year 1804.

LET not the critical reader condemn this case as unworthy of record: it is at least as important as many cases of the disease related by other writers; and will serve to exemplify some variety, not only in the circumstances of the disease, but in the method of treatment.

CASE II.

will be stated as it was communicated in a letter to a venerable physician who was consulted

on the occasion; with his answer. This is the case before alluded to, which particularly called the writer's attention to this subject.—Page 98.

"*Berwick* (*Doughtysfalls,*) *Sept.* 11, 1814.

"DEAR SIR,

"Six weeks ago last Saturday, Mrs. H. was brought to bed, after a favourable travail, with a moderate sized, healthy child. During the first three weeks of her confinement, every circumstance common to the puerperal state went on very well; she became comfortable, able to sit up most of the day, and to take, for the most part, such food as was provided for the family. But about the close of the third week, she was seized with pain in the right sacro-iliac region, extending to the hip, leg, and foot; accompanied with considerable tumefaction. The pain was occasionally so severe, as to prevent sleep, unless opium was given; and excited thirst, and other circumstances of moderate fever. The excretions of every kind had been regular and natural; but soon after the commencement of the complaint, the lochial discharge became more profuse than before. I directed a mild, thin, diet; and cooling drinks and medicines; paying particular attention to the alimentary canal, by giving, at first, an emetic, and by obviating costiveness, which the opium readily induced; by the use of senna, salts (sal sod.) laxa-

tive pills, &c. I applied various embrocations to the limb, such as linimentum volatile; solution of mur. am. or of common salt, in vinegar, camphorated spirit, tincture of cantharides, &c. &c. wrapping it in the mean time in burdock leaves and flannel. During this course, I introduced a few of the pil. hyd., with an intention gently to affect the salivary glands; but owing to some fallacy with respect to their strength, they produced a severe salivation; which continued above a fortnight. I also applied, most of the time, a bandage to the foot and leg; which she bore with apparent great advantage. Under this treatment she again recovered a comfortable state of health, being able to sit up most of the day, and to walk the room sometimes; but on Thursday evening the sixth instant, the left extremity began to be affected in the same manner, and seemed to be running the same career. Last Sabbath, the inflammatory state of the system appeared so considerable, that I took about half a pint of blood from her arm: the blood was sizy, and the evacuation has evidently afforded relief; the pain being mitigated, and the febrile symptoms less.—Mrs. H. is a person of a spare habit; of a delicate constitution; and often complaining of ill health.—The disease at present is almost wholly confined to the left sacro-iliac region, inguen, thigh, leg, and foot; which are affected with pain, tumefaction and soreness, though not very severe; but anodynes are in-

dispensably necessary to procure sleep. She nurses, and affords a sufficiency of milk; and has a tolerable appetite for light food. There is no lochial discharge at present; and no uneaness on that account. She is able to sit up in bed most of the time.—I daily apply to both extremities a spiral bandage; which appears to be very beneficial. The left extremity is enveloped in mullein leaves wet with vinegar, previously to the reapplication of the bandage. The tumefaction in the feet appears to be œdematous; but in the leg and thigh, inflammatory: and the inflammation seems to be deep seated; for the surface is of a natural colour and temperature. The applications keep the surface, for the most part, in a free perspiration.

"I CONSIDER this affection as an instance of 'Œdema lacteum,' of which I have never met with any account in books, except Motherby's Medical Dictionary; though I have several times seen cases of it in practice. Messrs. White and Trye are said to have written particularly on the subject; but I have never been able to procure the treatise of either. Knowing myself to be unacquainted with the real nature of the disease, and consequently, of a proper method of treating it; and believing you, sir, to be able to give me such information as I need; I presume to address you on the occasion; begging that you would be so kind as to write me by the mail, as soon as may be convenient; giving such directions

and advice as you may think proper. Your kind attention will much oblige

Your most obedient and
humble servant,
RICHARD HAZELTINE.

"Ammi R. Cutter, M.D."

IN a few days I was obligingly favoured with the following answer.

"*Portsmouth, 16th. Sept.* 1804.

"DEAR SIR,

"I RECEIVED yours of the 11th instant, and have attended to Mrs. H.'s case, which you state very clearly to be one of those often met with after delivery. My method of treatment has been very much like yours—blistering the part and using volatile or saponaceous liniments mixt with tincture of opium when the pain was severe—giving mild laxatives (if costive) and sometimes I have used fomentation or vapour bath. Recovery is often tedious; but they all do well that have come under my observation. The circumstance of one limb being attacked, after the other, is very common; but not so frequently for the disease to begin in the hip;—there can be no doubt but the case is truly puerperal; and that you will find the same success in treating the last limb as you did the first.

I am, Sir,
Your most obedient servant,
A. R. CUTTER.

"Dr. Richard Hazeltine."

This was the most severe case of this disease that I ever saw; and its importance in this discourse, will, I presume, justify a statement of some additional facts and observations connected with it.

1. Besides the internal exhibition of mercury, the Ung. Hyd. was freely applied to Mrs. H.'s lower extremities; but not while she was in a salivation. The unguent appeared to do no good without the bandage. Notwithstanding what is said by some in favour of the use of mercury in this disease, I am firmly persuaded that it is never necessary or useful, but injurious, beyond its mere cathartic effects, or those of a very mild alterative.

2. Though I had never read or heard of the use of the bandage in this disease; and though no one of several physicians whom I consulted, named it; after reflecting on the nature of the local affection; and the probable effects of the spiral bandage; the urgency of the distress of the patient induced me to try it; and its application was immediately succeeded by a mitigation of the pain.

3. At an advanced stage of this case, from the emaciation, paleness, and debility of the patient; an aged physician who was consulted on the occasion, proposed to administer the cinchona: and though I entertained no confidence in the prescription, I gave it a fair trial; but with very unpleasant consequences, even after only one

day's exhibition. I am persuaded that the opium which was given to assuage the sufferings of the patient during the progress of the disease in the *right* extremity, kept up such a degree of inflammatory action in the system as to give occasion to the attack of the *left*. I am confirmed in this opinion from the fact, that on opening a vein, while the blood was flowing, the pain abated, and continued less severe ever afterwards. Perhaps there are cases of this disease in which the circumstances are such as to require the use of the bark, opium, wine and other cordials, and nourishing food; but I must confess I have never seen such.

4. Nothing appeared to give any relief in this case, till after bloodletting and the application of the bandage.

5. The continued employment of the spiral bandage, and gestation in a chaise, were of singular service in this case, in removing the chronic effects of the disease. It is true, by the advice of others, the patient had recourse to a great variety of means to remove the tumefaction and debility from her lower extremities; but without any advantage, till in the succeeding spring, she was informed, by one of her own sex, who had also been a sufferer from the disease, of the efficacy of a *urinæ suæ haustus* for the purpose. She gave it a trial; and derived some real benefit from it. She drank, for several weeks, perhaps, half a tea-cupful at a time, almost every

morning, fasting; and found it prove considerably laxative, and sometimes nauseating.

6. Mrs. H. continued the use of the bandages the greater part of the time for a year; and such was the liability of her lower extremities to swell, that on getting up from a very severe fever in the spring of 1812, she was obliged to wear bandages three months: she was under the necessity of wearing them again about two months in an advanced pregnancy in the year 1813; since which, she has had no occasion to apply them, though her extremities are often swollen.

CASE III.

Thursday, P. M. August 13, 1807, I was called to Mrs. H. in travail of her sixth child. Her pains were regular; and on the rupture of the membranes, which was not premature, and the evacuation of the liquor amnii, the face of the fœtus presented. After the discharge of the waters, she had but few pains before the child was expelled; but nothing proceeded hastily. The placenta did not readily yield; and I thought proper to wait, perhaps, three fourths of an hour, before it was, with considerable effort on my part, *entirely* extracted. No unusual hæmorrhage;—no dolores secundariæ, succeeded; but pretty soon after getting to bed, she complained of a very distressing sensation at the extremity of the os coccygis. This, however, was

soon relieved, by the pressure of the hand of an assistant, and the application of flannel wet with vinegar.

Friday and Saturday, Aug. 14 and 15. As comfortable as common for the time—no dejection. I ordered an infusion of senna, salts, [sulph. sod.] and sem. cor., which was taken, and produced several motions.

Monday, A. M. Aug. 17. She had complained for the last 36 hours, of pain beginning in the right inguen, and extending through to her back, down into her thigh, with some uneasy sensation, even to her heel. The pain was occasionally severe. There was nothing unusual in the quantity or quality of the lochial discharge; no fever;* no heat; no thirst; clean, moist, tongue; no swelling in the pained parts;† frequent micturition; milk natural; skin soft. I ordered stupes to be applied to the inguinal region and other pained parts, wrung out of a decoction of discutient herbs in vinegar; and if these should not produce ease, to apply an epispastic. I put her on the use of strong antimonial wine in doses of ten or fifteen drops, every three or four hours; and left pills composed of opium, camphor and tart. ant., to be

* It may be remembered that fever is not a constant characteristic of this disease, according to the quotation formerly introduced from Rees' Cyclopædia.

† Mr. Trye says tumefaction does "not always" attend: Essay, page 7.

taken at night. This course removed every complaint in three or four days.

Some may question whether the foregoing was a real case of this disease; but in my mind there is no doubt of it: and I believe there are many such cases, which, occurring under the care of skilful practitioners, by some such simple expedients, are easily removed; and are, therefore, not thought much of; but which, were they to occur in places where proper advice could not be readily obtained, would become severe. I have known several such mild cases, and on having recourse to a cathartic, fomentations, and an antimonial, or to fomentations alone, the complaints have been speedily removed. If it be correct to consider the foregoing a real case of this disease; it will confirm the opinion of its local nature at the commencement.]

CASE IV.

Mrs. L. A. was subject to epilepsy; and accustomed to frequent bloodletting; without which the epileptic paroxysms very frequently recurred. May 3d, 1808, I waited on her in her sixth parturition. She was delivered, after twelve hours' favourable travail, of a full grown, healthy child. She had a remarkably good getting up, till the 6th of June; when, from imprudent exposure to cold, she was seized with

acute pain in her right side, accompanied with fever; for which she was liberally bled, purged, and blistered; and took antimonials, crem. tart., pulv. seneka, calomel, &c. &c. In a few days, she so far recovered of this illness, as to be able to ride abroad, two or three miles; but on Tuesday the 14th of June, forty-two days after lying-in, she was attacked with severe pain in her left inguen, which extended through the pelvis on the same side, and down the inside of the thigh and leg to the heel, and anterior part of the foot; accompanied with tense tumefaction, redness, and soreness. She was sensible of no precursor of this scene of distress, except passing a whey-coloured, turbid urine, in smaller quantity, and more frequently than common, during that day.

Wednesday, June 15th, P. M. I saw her—in a high fever, with a quick, frequent, tense pulse; great thirst, keen distress; the limb much swollen and tender to the touch: and she had been costive for several days preceding. I bled her freely; directed vin. ant. to be taken every two hours; gave calomel and other laxatives, to be assisted by enemata, till the intestinal canal should be freely opened:—ordered a large epispastic to the *part most in pain*, which was the lower and inner part of the thigh; and to be re-applied if the pain should shift; and to envelop the whole limb in burdock leaves wet with weak vinegar,

to be confined with a bandage applied as forcibly as she could bear it, without inconvenience. I left anodyne pills, to be given after the operation of the laxatives, if the pain should continue severe; and fetid pills, if certain nervous symptoms should continue, which I believed to be of the hysterical kind, and of which she had occasionally complained for two or three of the preceding days.

Friday, P. M. June 17th, I found her not much better, fever not so high, however, nor pain so severe; her tongue continued coated, and she was still costive: the pain had shifted from the lower to the upper part of the thigh; and had been followed by the epispastic; and the vesications in both places were complete. The pain had since moved to the inguen; to which part I ordered a new application of the epispastic. I gave her an emetic of ipecacuanha and tart. ant.; ordered the vin. ant. to be continued; and left a portion of senna, salts, and coriander seeds, for an infusion, to be taken the next morning.

Sunday P. M. June 19,—the emetic given on Friday, and the laxative yesterday morning, both operated according to expectation; and I have the pleasure to find my patient in every respect much better: the pain, swelling and soreness much less; the lochial discharge (or some other) which had never ceased, and had been here-

tofore, constantly natural, to day became somewhat fetid,—ordered the vin. ant. to be continued in nauseating doses; advised to promote, as much as possible, the discharge from the vesicated surfaces; and to continue the application of the burdock leaves and bandage, to the limb.

After this her recovery was very rapid and perfect: and in a month or six weeks, the use of the bandage was discontinued; and not a vestige of the disease remained.

CASE V,

is of comparatively recent date, and very interesting, as it is an instance of the existence of this disease, when not preceded by abortion, parturition, or any morbid condition of the uterine system.—Miss M. L. a young lady aged eighteen years; of a slender constitution and delicate health; of the purest morals and most amiable disposition; after exposure to cold on the 6th of last February, was attacked on the 7th, with the ordinary symptoms of synocha. These symptoms progressed mildly for ten or twelve days, and at length yielded in some measure, to the usual treatment in such cases; or were rather all suspended, except the febrile action of the heart and arteries, by hæmorroides cæcæ. The affection of the rectum continued quite severe for another period of ten or twelve days; then gradually disappeared, and was soon succeeded by pain, tumefaction, and

tension in the right inguen, extending through to the sacro-iliac region of the same side, and down the right extremity to the foot. The limb tumefied to a third larger than its natural size; was very tender to the touch; and contained many, of what the attendants called "bunches;" perhaps what Mr. Burns denominates "bumps."* This metastasis of the local affection was accompanied with a remarkably increased frequency of the pulse, from about an hundred, to upwards of an hundred and thirty beats in a minute, and by a no less remarkable mobility of mind. This morbid condition of mind, consisted of a very pleasing flow of ideas; and a disposition to be constantly talking and laughing: and the patient indulged the disposition almost incessantly; but her felicity was often interrupted by painful sensations in the affected limb. Her discourse was by no means incoherent or impertinent, such as attends delirium; but it was desultory, amusing and pleasing; consisting of charitable and friendly observations on the characters, conduct, and employments of people with whom she was acquainted; and on the kind offices of her relatives and others, towards herself. Some other circumstances characteristic of phlegmasia dolens, were

* "Principles of Midwifery;" Buchanan's edition; New-York, 1810; p. 305. These "bumps" had appeared in her superior extremeties and elsewhere, in the anterior periods of her sickness; indicating a disposition to inflammation.

observed; but I need not name them: let it suffice, that after minute attention to the phenomena, I did not hesitate to consider the case an unequivocal instance of the disease. The diseased condition of the system was now fixed; and was treated with various cathartic medicines, the most useful of which were, repeated doses of jalap and calomel, with or without nitre, according to the heat of the surface; pulv. camphor. and castor, with or without nitre; spirit of nitrous ether; vin. ant., and alkaline solution, taken into the stomach: and spirituous and acetous fomentations; camphorated spirit, anodyne liniment, which, by the by, in my opinion, was of no service; with the spiral bandage, which was of superior and immediate efficacy in the case, applied to the limb.

Neither was the disease in this instance connected with, or influenced in the least by, the catamenial efflux; for the patient experienced a regular visitation of this nature, the week preceding the commencement of her indisposition; and not another during her confinement.

[My respected auditors will indulge me one moment longer, while I narrate the leading circumstances of a case, which though not intimately related to the disease which I have been considering, is, nevertheless, so nearly allied, particularly as it respects the utility of the spiral bandage, that it cannot be deemed greatly impertinent to introduce it here.

CASE VI.

MRS. F. the mother of seven or eight children, was subject, during her pregnancies, to remarkable varicose distention of the veins of the lower extremities: I never knew any other person suffer so much from this cause. In February, 1812, I waited on her in parturition, under favourable circumstances. During the greater part of her preceding pregnancy, notwithstanding the most diligent employment of means suited to obviate unpleasant consequences, the varicose enlargement of the veins had been very troublesome. A few days after her confinement, the varices, instead of disappearing as formerly, became painful, inflamed, and finally suppurated. This took place in several of them. At first I endeavoured to prevent this process, by the employment of saturnine lotions, poultices, and other resolvent applications: but this plan proved altogether ineffectual it was not even palliative. Suppuratives were evidently indicated, and applied, and procured the most ease; but abscess, and ulceration indisposed to heal, were the consequences. New suppurations and ulcerations were taking place every day or two. In this state of things the use of the spiral bandage recurred to my mind; and being applied from the toes to the nates (for so extensive were the varicose distentions; and on both extremities;) no more of the varices inflamed; and in a few days they wholly disappeared, and the ulcerations healed.]

THE END.

ARTICLE V.

A

DISSERTATION

ON

THE PROPERTIES OF

ANIMAL AND VEGETABLE LIFE.

By HECTOR ORR, M.D.
Fellow of the Massachusetts Medical Society.

Read at the annual meeting, June 4th, 1817.

THERE is no subject, in the extensive circle of physiological investigation, which has excited more attention, or produced more opposite and contradictory opinions and conjectures than Vitality. But neither the wide-exploring researches of philosophy, nor the subtle and acute penetration of metaphysics, has advanced our knowledge of its real nature or essence, in proportion to the number of theories which have been fabricated concerning it. Notwithstanding the much desired light has not been elicited, experiments to determine the properties of living matter, and the

source of those properties which constitute vitality, have not been uselessly multiplied. The observation of facts has extended the sphere of improvement, and the speculations of experimentalists, in many instances, have been rendered practically useful by their subserviency to the elucidation of pathology.

We recur in vain to the medical records of antiquity for a distinct definition of life, or any distinct notion of what it is. The attainments of the ancients, in the knowledge of the true philosophy of the animal economy, were not proportionate to the industry with which they applied themselves to the study of nature. If we review the much famed splendid inquiries, which have immortalized the names of their authors, we shall be more amused by the ingenuity of the hypotheses, and the plausibility of the assumptions, than edified by the number and importance of their discoveries. We every where in their writings witness a vast assemblage of assumed principles, without the deductions which they suggest; a collection of bold and dogmatical assertions, without the necessary proofs; and much mystery conveyed in the imposing jargon of unintelligible terms, without the evidence of those facts, which their discussions promised. Their voluminous productions, like a long and dreary waste, present us nothing to gratify the eagerness of curiosity, nor any thing to compensate the toilsome search of the

diligent inquirer. The reflections of a moment must serve to convince us of the imperfection of their theoretical systems, when we recollect how little was known of the animal economy before the important discovery of the circulation of the blood by Harvey. And equally imperfect and impotent was the knowledge of vegetable physiology previous to the middle of the seventeenth century, when it was scientifically cultivated by Grew and Malpighi, two learned and celebrated naturalists, who, though unknown to each other, published the result of their investigations about the same time.

Researches into the cause and nature of living action were reserved for the more recent cultivators of physiology and medical philosophy. It is the moderns only who have elicited any light which can guide us in our inquiries into the faculties and functions of organic being, or have yielded us any promise of assistance in the attainment of that information, which remains to be acquired. Instead of pursuing their career of investigation impeded by the restraints of systems, the variable and unsettled principles of theories, or by unsubstantial and absurd inferences, drawn from illusive and ill-conducted experiments, they have with an independence of mind, and an elevation of genius, which, proportioning their exertion to the magnitude of the enterprize, opened the vistas which lead to the consecrated temple of physiological science, and

rendered it accessible to all. They have effected a revolution in opinions, without incurring the disgrace of innovation; have promoted the advancement of knowledge, and the dissemination of its beneficent effects, without seeking the acquisition of glory; and have so minutely investigated, and so perspicuously illustrated, every topic connected with their profession, that all pretensions to originality, and every claim to novelty are denied to their successors. Under circumstances so inauspicious to me, hopeless is the expectation of attempting a course, which has not been rendered familiar to all by the frequency with which it has been pursued;—and it is equally difficult, if not impossible, to avoid the hazard of discussing more imperfectly, a subject, which has often been elucidated by the ablest physiologists.

Though I shall digress on this occasion from the customary practice of discussing some pathological or therapeutic subject, I still hope, though digressing, to fulfil the design of the society in appointing an anniversary discourse. In the execution of this intention, I shall endeavour to present a brief sketch of the phenomena which are exhibited by organized matter, and essentially distinguish it from that which is unorganized. This distinctive characteristic is referible to vitality, by the operation of whose laws are produced those peculiar properties, which we discover in animals and vegetables.

To illustrate these vital properties, I shall institute a parallel description of the general characteristics of animals and vegetables, so far as they have been ascertained by observation and experiments on living matter, and are connected with our present inquiry. A subject so comprehensive, and embracing such a variety of objects, requires perhaps more space than the prescribed limits of a public discourse will admit. But it is presumed, that the structure of each being separately, though summarily considered, their respective functions and properties will be distinctly seen.

Modern physiology has not been content with the mere investigation of extraordinary phenomena, the knowledge of interesting facts, or the delineation of the peculiarity of living action in physical bodies, but has endeavoured, with invincible zeal and persevering industry, to penetrate the obscurity in which they are involved, and to divine their immediate cause. For the accomplishment of this object, mechanical philosophy has been rendered subservient to its purposes; and chemical science has contributed its full proportion of means to facilitate its progress, and to consummate its views. But notwithstanding the accession of these powerful auxiliaries, whose reasonings it has extensively applied to the unfolding of those truly sublime operations of nature, and the elucidation of that series of events, which follow each other

in the order of cause and corresponding effect, its success has not been proportionate to the extensiveness of its enterprize, or the magnitude of its exertions. It is to be regretted that even in these modern systems the tissue of extravagance and idle hypotheses have found a too easy admission, and that their authors, have not at all times recollected, that there is a peculiar unknown something which is denominated life, that maintains a distinctive and important character and influence in the living economy. They appear not even to have remembered that so extensively influential is this principle, that there is not an operation performed in the animal or the vegetable, in all their varied conditions of health, in which it is not incessantly active.

Equally numerous and unsuccessful have been the attempts of physiologists to facilitate the conception of vital causation by the invention and use of terms, or to give a concise and unobjectionable definition of life, which should convey an adequate idea of its real nature or essence. In the Brunonian System, it is asserted in a tone of pardonable enthusiasm, but with all the elation and triumph which ever accompanied an important discovery, "that health, disease, and predisposition constitute the living state, and that life is not a natural but a forced state." The absurdity of the expression has only been surpassed by the absurdity of the doctrines with which this system abounds. An improve-

ment of those philosophic reveries was attempted by the learned but visionary author of Zoonomia, who with more ingenuity than correctness of induction, assumed as a postulation, "that a lactum, subtle fluid, residing in the brain and nerves" effected all the vital changes, and was capable of satisfactorily explaining their origin. But it will be acknowledged that he has amused us with fanciful hypotheses, without distinguishing between cause and effect, and has substituted "mere statements of phenomena for explication of their origin." Equally unfortunate in his definition was the late Dr. Rush in his inquiry into the cause of animal life, where he has endeavoured to maintain the plausible opinion, that "life is the effect of certain stimuli acting on the sensibility and excitability which are extended, in different degrees, over every external and internal part of the body." This may carry the appearance of philosophizing, but will never be admitted as correct experimental logic. But so numerous and familiar are the examples corroborative of our position, as to render a further recital of them unnecessary. They are equally discordant as the contradictory decisions which have been past on the changeable hues of the camelion.

Life is neither a law, nor a substance; it possesses neither visible shape nor parts, and is not an object of any of our senses. We know it only, as we know its author, the primordial

fountain of life, by its effects. We are able to examine its properties, and to study its operations, but not to penetrate the veil which shrouds in inscrutable darkness, its cause. The intelligence of man is too feeble and limited to discover or define this great and anxiously sought for phenomenon of organization. It is equally evolved in the humble moss that vegetates at the foot of the oak, as in man, who, from the peculiarity of his structure, is destined to occupy a wider and a more extensive sphere of activity. The myriads of animals which inhabit our globe, and the mysterious and inexhaustible variety of vegetables, which diversify and embellish its surface, are organized beings, endowed with properties unknown and undiscovered in minerals or fossils, and which cannot result from any chemical affinities. They are characterized by a vital agency which is superior to the principles and laws of common inert matter. They exhibit, on an accurate inspection, one constant and uniform scene of motion and activity, of growth and decay, of waste and renovation, and of death and reproduction. Considered in their number, their variety, their elementary principles, their different functions, and their structure, they are incontestable evidences of unerring wisdom and contrivance, and yield us the most indubitable proofs, that nature has not abandoned even the most insignificant of her works to chance, to misrule, or to blind and random im-

pulses. They are so many organized bodies, and consequently so many living beings. All the phenomena of minerals are resolvable into the attractions and repulsions of cohesion, crystallization, gravitation, magnetism, electricity, heat and light. As they possess no organized structure, they can neither originate by generation, nor grow by nutrition. They derive their increase in bulk from crystallization, chemical attraction, or the juxta-position of extraneous substances, or from a dilatation of their particles occasioned by the expansive and repulsive power of caloric. But they neither see, nor hear, nor feel, nor smell, nor taste, nor are they moved, except by the impulse of impinging bodies. They are "masses of mere dead unorganized matter, subject to the laws of chemistry alone." We look in vain even among their curious crystallizations to discover a principle, which, by the most distant analogy, has any resemblance to the vital principle of organized bodies.

In every systematical investigation of the science of living matter, this common mysterious principle has been designated by different appellations, as if the potent spell of a name, significant of an effect only, should possess also the talismanic power of developing the cause. It was called Nature by Hippocrates, the Vis medicatrix naturæ by Stahl. It was the favourite Archæus of Van Helmont; the Excitability of

Brown; and the vis vitæ, the anima, the vital principle, and similar expressions of the recent cultivators of physiological science, invented by them to convey an idea of the unknown cause of the known operations in an organized body. But it is apparent from the very conception of the terms employed, that they are inadequate to explain the source from whence all the phenomena of life originate.

In all our attempts to philosophize, we have recourse to abstract terms to convey our secondary perceptions, and without this aid, we should be unable, either in reasoning or thinking, to make inferences, or to draw conclusions.—But these terms are not more objectionable on account of their total inapplicability to the communication of the intended knowledge, than with respect to their import. Each of these expressions implies a *unity* of the vital principle, one simple unmodified power, common to all living beings, and capable of explaining all the phenomena of vitality. The absurdity of such an hypothesis would be sufficiently proved by a very cursory examination of the animal or vegetable economy. There is not only an essential difference in the structure and texture of the different organs, but in the functions they perform. Will it be admitted that the functions of the brain, the heart, the lungs, and the stomach are referable to the same principle? It exceeds belief that a single principle is capable

of accounting for all the varied operations, the different functions and properties discoverable in these organs, since some of them are possessed equally by inanimate substances as by living bodies, and therefore not referable exclusively to a living principle. Or that the agency which animates, sustains and renews these organs, and the laws which regulate and govern the circulation in the heart, the respiration in the lungs, or digestion in the stomach, can emanate from one and the same principle. It scarcely requires to be observed, that such an opinion is predicated on a basis that is not tenable; and that no satisfactory evidence has ever been adduced in support of it. It has been founded on an unproved assumption, is opposed by facts, by observation and experiments, and will be rejected by common consent.

As great a contrariety of opinions prevails respecting the *seat* of this occult vital principle, as has existed among physiologists concerning its supposed unity. But when error is not a practical evil, the pertinacity of contumacious ignorance is harmless. Mr. Hunter maintained that it resided in the blood; M. Le Gallois in the medulla spinalis; while other physiologists of equal celebrity have respectively assigned it the heart, the lungs, the brain and nerves, as its appropriate residence and sole repository. But it has been incontrovertibly demonstrated by experiments, the accuracy of which has never been

questioned, that neither of these organs is exclusively the seat of the vital principle. It is a well attested fact that fetuses have been born alive, who possessed neither brain nor spinal marrow, and in whom no traces could be found that these organs had ever existed. It is also acknowledged that life is not immediately arrested in consequence of an ossification of the heart, an ulceration of the lungs, or a partial destruction of the brain, and that these organic lesions will occur, without producing a sudden suspension of their functions. The powers of respiration continue after decapitation, and the heart continues to act for an indefinite length of time, after it is removed from the body. But it is not the design of the present inquiry to attempt a reconciliation of the apparent contradictions and discordant doctrines and inconsistences, nor a refutation of the hypotheses which have been fabricated concerning them. Having no particular theory of our own to advance, nor any favourite tenets to establish, we do not feel ourselves privileged to indulge in conjecture, and must enter our solemn caveat against the entangling mazes of metaphysical subtleties, and the delusive but fascinating charms of physiological fictions.

As we can neither develop the cause of life, nor arrive at any correct definition of it by chemical analysis, nor gain any thing by reasoning on the nature of its principle; we turn to the consideration of the effects and phenomena of

vitality, which constitute the proper objects of physiological investigation.

Animals and vegetables alike experience all the vicissitudes of infancy, maturity, decay and death. The duration of their existence exhibits nearly the same phenomena, and the shades of resemblance might be traced through all the gradations from their first feeble and tender condition, their slow and gradual advancement in size and strength, their full and vigorous maturity, to their ultimate decline, and the euthanasy of old age. When submitted to anatomical inspection the analogy is equally plain and perspicuous. We see in each an assemblage of solid and fluid parts, intimately and intricately connected, mutually dependent on each other, exercising various functions, and organized into one perfect whole. Of these parts, the solid, inextensible, woody fibre, and the external cortical fibre of the vegetable is strictly analogous to the bones, shell, horn and nails of animals. Each of these possesses an insulation of vitality; has its periods of growth, and decay, and is alike subject to injuries, diseases, and death. And we might, without trespassing on the confines of fiction, pursue the analogy between the vascular system of the plant, and the lymphatic, and blood-vessels of animals, each of which is endowed with contractility and a susceptibility to the impulse of stimuli. On an examination of their respective systems, we every where see,

in their solid parts, vessels, distributed for the conveyance of fluids, which in the course of their circulation impart nourishment, and supply the waste occasioned by the excretion of old matter. All their vital organs are incessantly active during health, from infancy to decrepitude, and are never wearied, nor require repose. But by studying their anatomy we derive no knowledge of their functions. All we know of this, is acquired by patient and laborious observation, by frequent inspection of recently dead bodies, or by experiments made on living bodies. And all the information at present obtained respecting animals and vegetables, as living bodies, is restricted to a few particulars, which may be comprehended under a consideration of their composition, their structure, their functions, their appetites, and their vital properties. Each of which claims a separate and distinct discussion, in order to preserve the general view entire and unbroken.

From a cursory inspection of the animal and vegetable economy, it would be obviously inferred, that parts so different in conformation, and so distinct in their functions and vital properties, would necessarily be equally different in their composition. But we are not to confound their exterior form and attributes, and their immediate materials and integrant parts, with their elementary substances, which constitute the basis of their organization. We

cannot, however, in the present state of philosophical knowledge, and chemical analysis, affirm with unerring certainty respecting the various combinations of the elements which exist in animal and vegetable bodies during life, and co-operate with the vital principle; since all we know of these ultimate elements is derived from decomposition on the cessation of life. But so long as either an animal or a plant is capable of being influenced by the vital stimulus, the constituents of their immediate materials, are not susceptible of forming any other combinations, nor are they subject to the laws of chemical decomposition. It will be recollected, and with regret, that such is the peculiar nature of all living matter, that it is impossible, in its living state, to subject it to such decisive experiments or chemical analysis, as have so amply contributed to improve, illustrate and exalt the science of natural philosophy. But so far as chemists and physiologists have hitherto extended their researches and observations, they have found these ultimate elements a common boon, participated alike by vegetable and animal bodies. It is these elements which we particularly regard in their composition.

The same remarks which will apply to the *structure* of a living animal body are equally applicable to a living plant. In both we observe an assemblage of individual parts differing in their fibre, composition and tissue, possessing

their respective and appropriate organs, but differently modified and harmoniously combined into one whole. Nature has variously interwoven and united these parts, and established among them a difference of texture and configuration by which they are perfectly identified. But in the form of the organs, nature claims no superiority over the wonderful subtility of mechanism, which possesses the power of imitating them in shape, size and colour, with a correctness of resemblance capable of imposing on the senses of the inexperienced. But art, though plastic, cannot reach their elementary parts, nor successfully imitate their inexplicable texture.—These are produced, assimilated and elaborated by the vital functions. In considering therefore the structure of living bodies, we are principally to regard the texture of their different parts, the combination of parts of dissimilar texture, and that configuration of the various organs which results from such combination.

In discussing the *functions*, I shall not adhere to their arbitrary divisions and subdivisions into classes, and orders; but shall pursue a course more summary, and attended with less prolixity. And in rejecting every classification with which we are acquainted on account of their palpable inaccuracies and inconsistencies; we feel compelled, at the same time, to withhold our approbation of the visionary chemico-animal philosophy of some modern physiologists, not more for its encouragement of materialism,

and its demoralizing influence, than for its total incapability of explaining those vital actions, which we believe are solely the production of a distinct principle, whose agency results from the animating power on an organized body. In describing therefore the functions, it is necessary to demonstrate that the organs possess certain powers peculiar to living bodies. For if they maintain a certain configuration, and are composed of parts of a certain texture only, without some other characteristic, they cannot be discriminated from dead matter.

In tracing the analogous functions of animals and vegetables, let us examine those which serve for the preservation of the individual, under the triple relations of those of assimilation, those of formation, and those of excretion. By the performance of these complicated functions we can satisfactorily account for the growth, the waste and consequent reparation of the system, and the subserviency of vital support to vital action, without having recourse to chemical affinity or aggregative attraction. And in passing, it will not be irrelevant to observe that all the organs which have been called vital, are hollow muscles, but destitute of opponent muscles, and that they are elongated by their contents, which contents, except in the alimentary canal, are in a fluid state, and excite these organs to contraction.

By the functions of *assimilation* foreign matter, which consists principally of dead animal and vegetable substances, is constantly and uniformly converted into the peculiar nature and substance of the animal or vegetable which has taken it for its nourishment, support and renewal. The apparatus subservient to this purpose in animals, consists of various organs, as the mouth, the stomach, the intestines and chyle vessels, in which the aliment is received, decomposed, differently modified and conveyed into the mass of fluids, to maintain the perpetual change in the materials, which enter its composition. It will be generally conceded that no chemical or mechanical forces are adequate to the accomplishment of similar results; and that the process of assimilation is therefore an effect of the operation of the living principle. To remove even the possibility of a doubt, let the experimentalist, aided by chemical and mechanical agents, produce from any combination of matter, chyle or blood. But in Nature's laboratory, however heterogeneal may be the quality of the food, the same kind of blood and chyle is constantly and invariably produced from it. No difference of climate, no national peculiarity, nor any regimen, from the simple food of the first progenitors of the human race, to the profuse variety of the modern delicacies of an epicurean banquet, have effected a deviation in the result of this process. The same

red blood, in quality, flows in the vascular system of the Italian, who revels in the luxuries of his macaroni, as in the veins of the Kamtscatkan, who gormandizes the rancid fat of the whale ;—the same in the vessels of the Caffre, whose principal food is milk, as in those of the Mongal or Calmuck, who with equal avidity devours the flesh of their horses ;—the same red blood circulates in the arteries of the Turk who subsists on rice, as is found in the arteries of the Moor who confines his repasts to figs ;—and the same is observed in the vessels of the Hindoo, who never mixes animal food with his rice and ghee, as in those of the natives of our western wilds, who feast on jerked venison, rendered grateful to their palates by being enveloped in bear's oil.

Having seen what passes in the animal body, let us examine the vegetable system, and observe how this process is conducted there.—Though experiments, equally numerous and decisive, have not been instituted, by which the organic functions of plants would be incontrovertibly ascertained, nor has vegetable physiology, been investigated with that zeal which characterized the labours of the ardent and penetrating Bichat, yet, as limited and as imperfect as is our knowledge, enough is known for the purposes of our discussion. Plants are furnished with an apparatus of minute and delicate vessels, which are perfectly analogous in

their functions to the stomach, lacteals and arteries of animals. The aliment which the roots receive from the soil is deprived of its nutritious particles by the sap vessels, and these nutritious portions are conveyed by absorption into the fluids, and by the circulation of the sap they reach the flowers, the fruit and the leaves of the most remote branches. It has been experimentally, and unquestionably demonstrated, that there is not a particle which enters into the composition of a plant, that is stationary for a moment, and that this change is incessant not only in the trunk, but in the extreme part of their leaves. From this view of the vegetable economy, we shall not incur the imputation of a petitio principii, if we affirm that there is not any one conceivable part of time, in which it could be possible for chemical or mechanical powers to exert their influence. We must therefore infer that vegetables like animals assimilate the food they receive, perform their destined functions, and by means of the nourishment they receive, attain a magnitude unparalleled among other organized bodies. It is in the diversified operations of their respective economy, in this intricate round of the functions, that consist the truly sublime considerations of philosophy.—Whatever may be the particular nature of the food absorbed, or other local circumstances, we witness in the same species of vegetables, the same unchanging effects are produced from it.

In our own forests we see the oak, the maple, and the pine, taking root and growing in the immediate vicinity of each other, drawing their nourishment from the same soil, surrounded by the same temperature of the atmosphere, imbibing the same dews, refreshed by the same showers, and invariably the same in all the external circumstances, which are necessary for their growth, their support, and to supply their continual waste. Whatever may be the properties of the aliment which the root-vessels of these tress respectively receive, the maple will constantly and uniformly produce a saccharine juice, and the pine a resinous fluid. The agency of the vital principle only is adequate to account for these wonderful operations, though we are unable to comprehend the instruments by which they are effected, or the laws by which they are regulated.

In the preceding observations on the animal economy, it was intended to give a sketch only, a mere miniature representation of animalization, without describing the various changes of the food in its circuitous course through the chylopoietic viscera, its decomposition in those organs which subserve assimilation, or the additions it receives, or the parts it rejects. The fact is sufficiently obvious, that each organ takes from the circulating current the aliment which is best adapted to the fulfilment of the designs of nature, and will most effectually contribute to

the nourishment, the increase and renewal of the body. But whatever may be the quality of the food received by animals for assimilation, it is decomposed by the digestive and secretory organs into earth, alkalies, acids, neutral salts, albumen, fibrine, mucilage, &c. And in vegetables, by a similar process, it is converted into earth, alkali, acid, mucilage, &c. forming a catalogue of vegetable matters of too formidable length to enumerate on this occasion. The secretion of a substance which has not the most distant resemblance to the food received, is the exclusive property of a living being.

In sketching the leading facts connected with the functions of assimilation, we necessarily glanced at the functions of formation, by which we have partially anticipated many of our remarks on their distinctive characteristics. The extreme vessels are the organs principally exerted in the performance of the functions of formation, and are the media through which is originally and successively communicated the new matter, of which are formed the various solid and fluid parts of our bodies. It is these curious and interesting operations of the animal economy, which so much excite our admiration. The capillaries are the reservoirs of that heterogeneous fluid, the blood, from which the exhalant and secretory vessels, and those which perform nutrition, derive their supply. And we every

where see this unbroken continuity of supply equal to the perpetuity of waste. During this incessant change, the body maintains nearly the same external configuration, and the same form and texture of its internal organization. We shall in vain resort to chemical agency for an explication of the process of nutritive elimination from alimentary substances; and we shall find it equally difficult to account for the subsequent union of the secreted fluid with the solid and the fluid parts of our bodies by the effects of a mechanical juxta-position of particles. Similar general and individual laws which govern and direct the animal economy, preside also over the vegetable system. They are immutably established both in the external and internal structure of every animal and plant, and either accompany or arise from organization. In the same species, whether of animals or of vegetables, we observe nearly the same shape, size, disposition of parts, and complexion or colour, perpetuated through succeeding generations. The distinctive character of the Ethiopian is not more permanently fixed in his features, figure, complexion and stature, than that of a plant in its trunk, branches, foliage and fruit. The peculiar black skin, the curled hair and depressed features which the African exhibits at this day, were exhibited in the ancestors of his race a thousand years ago; and the aloe, in an equal space of time, has preserved invariably the same singular configura-

tion of its leaves, and the same variety of spots, and various hues of its blossom. Hence we infer, that we derive no knowledge from the chemical analysis of soils, by which we can detect the common principle subservient to the nutrition of vegetables; and that the separation and assimilation of nutritive matter is predicable only of a vital action.

If the preceding view of the subject is, on investigation, found to be correct, it may be applied to the explanation of the nature, and the improvement of the treatment of certain diseases. Dr. Cullen and his humble devotees, imagined that a saccharine matter was the prime principle of nutrition; but would one of the disciples of this school undertake the cure of a diabetic patient, in the extreme stage of emaciation, by the exhibition of sugar? Or, what scientific physician would administer the phosphate of lime to an infant afflicted with the rickets, because it was evident that the disease arose from a loss to the bones of a due proportion of this substance? These and similar disorders are only remediable by an excitement of those vessels in which are performed the functions of formation.

We have seen, in considering the functions of assimilation and formation, the constant change which the whole animal and vegetable body suffers by the perpetual deposition of new matter, and the incessant renovation of parts. We are

next briefly to notice the function of excretion, by which, in the natural routine of the system, the old solid and fluid parts of their bodies, and even the vessels themselves which perform this office, are decomposed, and conveyed away by the emunctories. The enumeration of the various excrementitious fluids which are ejected by the excretory vessels in animals, is unnecessary in this place. We announce the fact as incontrovertibly established, and believe that it can be demonstrated, that vegetables are endowed with analogous functions. The belief of the existence of these functions in plants is not founded on inferences drawn from mere suppositions and loose conjectures, but from experiments and observations, which have been made with an accuracy and fidelity that does not admit of deception.

Those functions which we have rapidly sketched, and to which we have confined our observations, are exercised in common, and possessed by the individuals of each sex; and in further prosecuting our inquiry, we shall with equal brevity attempt the consideration of those which have been denominated the sexual functions, which were provided by nature for the preservation, not of the individual, but of the species.

An identity in the phenomena of the generative process in animals and vegetables supposes an identity in their sexual organization. But the organs and vessels which are concerned in

perpetuating a succcession of organized beings of similar species are so familiarly known as not to require an enumeration, or any particular description on this occasion. And it may be further remarked, that most theories respecting conception are mere philosophical speculations, unsupported by a series of connected and well authenticated facts, and so far exceed probability, as to surpass belief, and to put honest credulity to the blush.

It is manifest to common observation, that there is an incontrovertible similarity in the process of the reproduction of the same species of animals, and the same species of vegetables, by sexual intercourse. The manner in which the vivifying principle, which animates the germ produced by the female, is communicated, is more than merely analogous. In vegetables the anthers of the stamens eject the pollen on the stigma, similar to those animals in whom reproduction is performed by the approximation of organs. In this admirable economy of nature, though her recesses have never been satisfactorily explored, we witness the synchronous operations of the sexual functions, by which the species have been perpetuated.

It is very evident that there prevails not only a diversity in their reproductive organs, but a difference in the mode of propagation. The Abbe Spallanzani has demonstrated by his observations and experiments on frogs, toads and

newts, that the introsusception of organs in these animals is not necessary to their reproduction. And in like manner the functions of the stamens and pistils, in many vegetables, are accomplished without contact, the pollen being brought to the stigma by the air, by the foot, and by the wings of insects. But by whatever means this commixture of the pollen with the fluid which moistens and covers the stigma is accomplished, the fecundating stimulus is communicated, by which fruit is perfected, and the designs of nature fulfiled.

THERE also occur both in the animal and vegetable kingdoms, anomalies resulting from the sexual intercourse of different species; where the sire is of one kind and the dam of another. In the animal productions of this description are mules, the offspring of the horse and the ass, and mongrels, the progeny of the wild and the tame goose. Among vegetables the hybridous plants are occasioned by the pollen of one species falling on the pistilla of another; many curious and singular instances of which have been recorded by Linnæus, the accuracy of whose luminous experiments has never been questioned, nor has his veracity been impeached. Were it necessary, various examples of similar deviations from the usual course of nature, might be adduced in corroboration of the principle intended here to be established.

Modern physiologists have likewise attempted to prove the vitality of vegetables by the phenomena of their diseases. This subject is both curious and interesting to the naturalist, and, if scientifically investigated, unincumbered by previous theoretical impressions, might be rendered of practical utility to the agriculturalist. A full development of our views on this topic would require a minuteness of detail, and length of discussion, that would be inconsistent with the limits of our present inquiry. There is nothing fanciful, however, or enthusiastically unreasonable in the suggestion, but on the contrary, innumerable instances are to be found in every physiological treatise on botany. In the diseases of animals and vegetables there is not merely an imaginary resemblance, founded on the uncertainty of presumption, but the analogy is established by the clearest and most demonstrative evidence. The same want of vital energy in a part, or the same weakened action of the vital functions, which terminates in sphacelation, gangrene, or mortification in animals, produces the same diseases, with all their attendant circumstances, in vegetables. The effects of mechanical lesion, of frost, of poverty to the one, and unskilful husbandry to the other, are attended with the same deleterious consequences in each. When either is exposed to the rigorousness of excessive cold, the functions in the extreme parts are disorganized, the secretions ob-

structed, the fluids in their vessels interrupted, and the part becomes decomposed and subject to the laws of dead matter. When the same effect no longer results from the same agents, disease is the necessary consequence. Like animals, vegetables frequently languish, sicken and die, from the ravages of parasitic animals and vegetables. This is particularly exemplified in the mildew, the blight in corn, the ergot in rye, the moss which fixes on old trees, the morbid protuberances on oaks, and the depredations of the aphis, the puceron and the caterpillar. Had there been the same strong inducements to study the peculiarity of the constitution, and to investigate the distinct nature of living action in vegetables, as there has been evinced in the elucidation of the animal economy, we should have attained a more perfect knowledge of their diseases.

It is familiar even to those who have never systematically engaged in physiological researches, that a certain degree of heat is requisite to maintain animal existence, and to support the vegetative principle. Many individuals, of both of these kingdoms of Nature, also possess the power of maintaining a certain temperature amid the perpetual snow of the polar regions, or the intense warmth of the torrid zone. These are well known facts, and, if the evolution of the caloric, which supports animal temperature, is allowed to be a secretion, it must necessarily

be regarded as a function of the nervous influence. From the admission of this fact, we deduce the evidence of the existence of a nervous system in vegetables, since it will be granted that they also are capable of occasioning an evolution of caloric.

These remarks on their analogous composition, structure, and functions, were necessary preliminaries to a consideration of their vital properties, which result from their respective organization, and are exercised in the performance of the functions.

These vital properties vary in number, degree and intensity, according as the organization is more or less complicated and elaborate.—Hence they have been differently denominated by different physiologists, and the exposition of their cause and origin has produced various and contradictory hypotheses. Among the competitors for the honour of discovering their true source, a few, allured by the meteor glare of novelty, have reposed a pretended confidence in the potency of galvanism; others of equal pretensions, and equally enthusiastic, have accounted for their phenomena by the influence of electricity; and those, who have renounced the philosophic reveries and illusive dreams of the ancients, have found an easy solution of their cause in mechanical and chemical agents.—Hence systems have been built on the hypotheti-

cal doctrines of vibrations, oscillations, electrical attractions, and chemical actions.

It will be deemed superfluous, on this occasion, minutely to detail the evidence of the existence of the vital properties belonging to living bodies, or circumstantially to point out the process by which they may be discovered.—We show what they are, and define them. And in our selection we shall enumerate only those, whose existence has been the most unequivocally ascertained, and which have been recognized by the most approved physiologists. In describing them it will be evident that they are distinct properties, and that the aggregate of these properties is to be regarded as constituting animal or vegetable life. We shall consider them as consisting of mobility, irritability, vital affinity, vivification, sympathy, and sensibility.

We begin with *mobility*, which is an original power of motion in living beings, and is manifested in those organs which perform the functions of assimilation, formation and excretion. It is a property which cannot with strict propriety be said to reside exclusively in the muscular fibres, for parts in which no such fibres have been demonstrated are capable of original motion. All the moving parts of the body are capable of moving themselves independently of any external motion impressed. Since it has been conceded by every physiological writer

that it is a property belonging both to living animals and vegetables, it is unnecessary to multiply illustrations.

Another character of all organized bodies is *irritability*. This is a property in animals by which external applications to particular parts excite a motion in the moveable parts, independently of the motion impressed. We regard the muscles as its essential seat, and in its modification we recognize a diversity as various as the peculiar and specific mechanism of the muscles. Though it presides over those organs which possess mobility, it is discriminated from it by being found to reside in parts, in which this vital energy is not exercised. We also observe it in the blood vessels and the lymphatics, and can trace it in parts remotely situated from those to which the stimuli are applied. We would adduce in confirmation of this position the familiar instance of the application of irritation to the different mucous surfaces, as is evinced in sneezing in consequence of irritating the pituitary membrane, or coughing from an irritation of the bronchiæ; not to mention the spasmodic vomiting which is produced by biliary calculi. Having observed that contraction succeeds irritation in all cases, excepting those of the iris, the corpus cavernosum, and the sphincters ani, vaginæ, and vesicæ, it has been inferred by professor Blumenbach, and most of the zealous

opposers of the celebrated Hallerian theory of irritability, that *contractility* is a distinct vital property. But it is equally obvious in the examples recited, that contraction follows dilatation, on the removal of the irritation, as the muscles in other cases of irritation resume their former situation and dimensions on the discontinuance of the contraction.

Consistently with my design in this analogy, it is necessary to demonstrate that irritability is also a property of vegetable life.

Innumerable experiments have been instituted with a view to determine the existence of this property in vegetables, and from the result of these experiments there can no longer remain a doubt on the subject. To what, I would ask, shall we attribute the motion of the sap, but to irritability? It has been ascribed to the peculiar form of the vessels, and to the agitation of the wind, but these cannot be admitted as adequate causes. Neither will we allow that it is occasioned by the action of heat, nor believe with Tournefort, that it is propelled through the vessels by capillary attraction. It is manifest that it cannot be owing to the influence of heat, since it is well known that the sap vessels originate in the alburnum and near the pith, and that the sap flows in the forest in the spring before the greatest warmth of the solar rays is felt.—And it is repugnant to reason and sound philoso-

phy to believe it possible for capillary attraction to be exerted to the known altitude to which the sap ascends.

The fall of the decaying foliage in autumn, of every deciduous tree, or shrub, is to be accounted for on this principle only, the state of its irritability, and not by any chemical or mechanical agency. The foot-stalk of the leaves and leaflets of the sensitive, and many other plants, when irritated, exhibits undeniable proofs of this vital property. Thus it is evident that the application of irritants cause the fibres to contract, and the contraction gives motion to the leaf. We therefore consider it as a fact demonstrated, that if contractility is a property of animal life, it belongs also to vegetable life.

We shall next consider *vital affinity* as one of the energies of animal and vegetable life. I cannot better illustrate the subject, than by adopting the sentiments and quoting the observations of the inventor of this term,* who has remarked that the facts, from which the existence of this property is inferred, have not escaped the notice of modern physiologists, notwithstanding they have not characterized it in their classification of the vital powers. The name, though borrowed from the analogy presented us by one of the sciences, will be acknowledged

* I am indebted to James Jackson, M.D. Professor of the theory and practice of physic in Harvard University, for the terms vital affinity and vivification. New-England Journal Vol. V.

appropriate, and that it sufficiently designates a source of action, and the effect, which constantly occur in certain physical phenomena, without confounding it with those mutual attractions or affinities which are purely chemical.

This vital property is recognized in every living organized being, and must exist in every part of matter endowed with vitality. If this fact is not sufficiently ascertained, it is rendered more than probable that the first communication of it to foreign matter is in the digestive process, and that the subsequent assimilation of the nutrimental fluids forms new combinations. This we witness both in the animal and vegetable economy, where we see the fluids separating and combining in new affinities, and the action of the solids controlling the affinities and new combinations of the circulating fluids. This is not simply chemical, for if the elements of living bodies were combined by chemical affinity, they would not undergo decomposition. We know that the ultimate elementary particles, the basis of organization, are the same in all substances, but their combination in living bodies, by attraction or affinity, is different from the combination of these particles in inanimate matter.

The facts, from whence the evidences of the existence of this property in animals are adduced, have been ascertained with a precision and certainty that cannot leave a doubt on the mind of any physiologist; and from the foregoing ob-

servations on the functions of secretion, nutrition and assimilation, it must, I think, satisfactorily appear, that vital affinity is a property of vegetable life.

Another property of life, which presents itself to our notice is *vivification*. In the countless multitude of organized beings, by whom we are surrounded, we recognize a constant, never-ceasing change of the particles of which they are composed, and by which they evince incessant material death and reanimation. All organized matter must be perfectly decomposed or dead before it can live; must be decomposed or dead in the stomach of animals, or in the soil which nourishes the plant. This conversion of inanimate to animate matter yields us the most satisfactory proof that we have only a faint and evanescent glimpse of the intricate and admirable operations of nature, and of that steady and ceaseless energy by which the same effects tend to the accomplishment of the same ends. It must be regarded as one of the mysterious, if not inexplicable phenomena, that life is maintained and communicated, amid perpetual dissolution. This property in living organized bodies of making other matter live, is vivification, and it exists in the extreme vessels which perform the functions of formation.

We have seen these organs of the vegetable destined to exercise the formative functions, exerting an influence on the fluids, by which, not

only the perpetual waste of the parts is incessantly supplied, and the parts themselves renewed and supported, but animation or life successively communicated to these renovated parts. While these organs are bestowing on the different parts their peculiar structure and composition, they bestow on them at the same time, their appropriate vital properties. From this concise view of their functions, it is as obvious that vivification is a property of vegetable life, as it is to infer from their increase, that food is received into their system.

According to the order of arrangement, which I have adopted, *sensibility* is the last vital property proposed for consideration. In the illustration of this subject, perhaps it will be imagined, that I have attempted to give to the vegetable system a character, which no correct physiologist will allow that it possesses; a character which all, who feel a pride in the dignity of human intelligence and the importance of the intellectual functions, believe that nature has intentionally withheld from it. But whatever rank is assigned to vegetables in the scale of creation, we know that they possess all the other properties of life, manifested by animals in the exercise of their functions; and if we cannot satisfactorily prove that they are endowed with sensibility also, I shall be content with rendering it merely probable. I feel justified in the attempt, since the contrary opinion, which is

universally embraced and propagated, has never been incontrovertibly demonstrated.

By the recent investigations of the operations of physical bodies, we are more completely initiated into their arcana; and conducted by their various analogies and discrepancies, we pass the threshold of enlightened philosophy, to the inextinguishable light of truth. Those phenomena, which cannot be accounted for by electricity, or galvanism, or by any chemical or mechanical principle, are not for this reason to be considered as inexplicable, and consigned over to be ingulfed in the interminable vortex of mysticism. We would rather allow to the humble vegetables, which carpet the earth on which we tread, perfume the air we breathe, and delight the eye with the richness and variety of their hues, the possession of a vital energy, which is not denied to the worm that entwines itself in their roots, or the insect which revels in their blossoms, or preys upon their leaves. But let it be remembered, that however degrading in human estimation may be the situation, which vegetables are destined to occupy, the air which they evolve is inhaled by man, and that the materials which circulate in their frame, in the circle of eternal change and regeneration of matter, may shortly hold communion with an immaterial spirit.

We live in an age of progressive improvements in all the sciences; and within the short

and evanescent period of our own recollection, facts have been multiplied respecting the laws of the vital functions, which admit of no parallel in the annals of physiological records. The moderns, as if unwilling that any thing should escape their scrutinizing researches, have had the presumptive hardihood to subject to the most cruel and torturing experiments, the bones, the tendons, the ligaments, cartilages, &c. of animals, possessing intelligence, the faculties of speech, and the capacity, in the most significant and unquestionable manner, of communicating their sensations, to determine if they possessed either vitality or sensibility. By cutting, pinching, tearing, burning and irritating, by chemical and mechanical agents, they have at length demonstrated that these parts, before deemed insensible, are endowed with both life and sensation. And may it not from hence be inferred, that as the structure and intimate nature of the organs of plants, are so nice and delicate as heretofore to elude anatomical investigation, that they may nevertheless possess sensibility in proportion to the minuteness of their structure? If not in the perfection observed in the more perfect animals, equal at least in degree, with many in whom there has not been discovered either a brain or a nervous system? We have been furnished with no data, nor standard, nor criterion, by which the admeasurement of the degrees of sensibility is to be precisely ascer-

tained, or the capacity, which the individuals of different species possess of enduring pain, or of enjoying happiness. It has not been proved that the sensibility of zoophytes, in whom there exists no evidence of a nervous system, is not in degree equal to that of an elephant or rhinoceros, whose nerves are proportionate to the size and magnitude of their bodies. Nor does it appear that the sensibility of living fetuses born without a brain, and worms, insects, crustacea, and mollusca, in all of whom a brain is wanting, is not commensurate to that of the human species. We believe that vegetables have as strong a claim to be characterized by this property as clams, or oysters, or polypi or the myriads of animalculæ infusoriæ. We regard not the circumstances which originate in their necessities, whether they walk on two or four legs, whether they creep on the surface of the earth, or wing their way through the trackless regions of the air; whether they pursue their silent course through the bosom of the ocean, or respire through lungs or gills. If they live they feel.

We assert it as a fact, incontrovertibly established, that there is no definition of irritability as yet invented, not even admitting the influence of this property in its most unlimited and unrestricted application, which is adequate to the explanation of many of the phenomena exhibited by the mimosa sensitiva, and numerous other singularly curious plants. I have not, however,

the temerity to affirm that these are positive, conclusive and plenary evidences of sensorial power; but I am bold to assert, that there is no chemical or mechanical principle, or any known vital energy applicable to their explanation, but sensibility. We do not appeal, for a decision, to opinions, the vague and indeterminate criterion of truth, better calculated to mislead, than to convince the doubting; but to undeniable, authenticated facts, to be found in almost every treatise on vegetable physiology. We have no hesitation in maintaining, that if we attempt a solution of their mode of action, other than that resulting from sensibility, we shall be involved in a perplexity of causes, as interminable as a circle, and which leave the solution as inexplicable as the fact itself. From the definition of irritability it necessarily follows, that the application of an irritant to the same part of a vegetable must be invariably accompanied by a manifestation of the same event. Let us see how apposite this distinguishing characteristic of irritability is to the well attested instance related by Gerardin of the mimosa sensitiva, which was conveyed by the celebrated Desfontaines in a carriage to a considerable distance. The first effect of the violent motion of the coach was to induce a contraction of the leaves of the plant, but after a lapse of a few moments, notwithstanding the motion of the carriage was continued with equal violence, no collapse of the leaves occurred.

Hence it may be reasonably inferred that the power of the application, producing sensation, in this instance, was diminished or destroyed by custom; as is evinced in the inhabitants residing in the vicinity of stupendous cataracts, who become insensible, from custom and habit, to the impressions, which the incessant roar of these waters are calculated to produce.

An additional argument in confirmation of our hypothesis, possessing in our estimation that weight of evidence, which renders it more than probable, is, that vegetables exercise vital functions analogous to those animals, which possess the organs on which sensation depends. In the most perfect animals supplied with a brain, spinal marrow, and a common sensory, nutrition and secretion are evidently influenced by the nervous power; and observing that the functions are performed in plants and the less perfect animals, in whom neither brain, nor nervous system has been detected by the most accurate inspection, we cannot hesitate to allow it as a necessary inference, that a power resembling the nervous influence, or the more circumscribed operation of a nervous system, must also exist in them. Whatever therefore, either in animals or vegetables, acts as a substitute for a nervous system, by exercising its functions, whether it be instinct, electricity or galvanism, must be capable, in the most unequivocal manner, of communicating the impression of a stimulus,

from the irritated contractile fibre, to the common sensory, where it is perceived or felt.

To avoid the imputation of practising a disengenuous evasion of the question, and to prevent any ambiguity which may arise from the use of terms, we shall admit, as an approved definition, by the best physiologists, of sensibility, that it is that property in the organs, by which we are apprized of the impression made on these organs by external substances. To this it will not be objected, that the motion of the blood in the heart and arteries is not felt, or that certain organic, visceral and fibrous contractions, excited by the appliction of stimuli, are not communicated to the common sensory. It is notorious that in these instances, we are not apprized of any motion produced, nor of the sensation superinduced. But we hasten to make the application of the definition to the vegetable system, by inquiring, how the dionæa muscipula is apprized when to close its singularly constructed leaves, and to seize upon the insect that has entered its bosom, and not again to relax its grasp till its prey expires? The impression here made elicits a motion, but not by the application of a stimulus to the contractile fibre, to the footstalks of the leaves, and is not therefore to be regarded as a case of simple irritability. The silene, the dipsacus, and the whole class of flycatchers, as they have been denominated by botanists, equally evince this property.

It will be readily conceded, that where a common sensory exists, it is reasonable to infer, that sensibility is a property of such a being. In all animals possessing a sensorium, the voluntary motions are commenced, suspended, renewed, continued, or accelerated by an act of the sensorium conveyed by the interposition of the nerves to the muscles of voluntary motion. It will also be acknowledged that the excitement arising from internal feeling, manifested by voluntary motion, exhibits evidence of a sensorial power not to be invalidated. I shall therefore endeavour to make it appear, by facts, sufficiently numerous, that voluntary power is also predicable of vegetables. Though I would not be understood to advance the assertion, that the phenomena noticed are strictly acts of volition, but in as much as they are not influenced by any known external stimuli impressed, we contend that they furnish at least presumptive evidence of excitement from internal impulse. That by a certain sensation a wish or desire is excited in the vegetable to perform a particular act. It may be illustrated by the facts observed in the gloriosa, in the season of the year when sexual appetency is indulged. At this period the stile of this plant is bent at a right angle from the very base, for the evident purpose of bringing the anthers and stigmas together. In the saxifraga, and the parnassia also, the stamens successively lean over the stigma, and retire after they have deposited

their pollen. The hedysarum gyrans, a native plant of Bengal, commences, discontinues, retards, or accelerates the motions of its leaves at pleasure. These motions it performs independently of any external agents, in the stillness of a calm, and the absence of light. The inferences to be drawn from these facts do not require any metaphysical aid to render them more intelligible.

MANY similar proofs might be adduced in corroboration of this hypothesis, but I do not wish to add to the length of these remarks, the additional burden of a multiplicity of examples. It is impossible to dismiss them, however, without observing that many motions of plants have the *appearance* of being excited by the feelings of desire, aversion, and want. By the agreeable stimulus of light and warmth, the daisy, the sun-flower, the marigold and whole fields of clover regularly turn their front to the sun. If we place the leaves of a plant in an unnatural position, they instantly reassume their original situation, as if incited to it from the painful feeling of an unaccustomed condition. They are also seemingly impelled by the feelings of hunger and thirst to multiply their means of gratifying their appetites, by sending out their roots in all directions to search for food. We daily see the roots of pines, which grow on bare rocks, descending, and extending themselves to reach the soil below, or suddenly turning into the crevices to seek for nourishment

there. We would further remark that vegetables are sensible to the enjoyment of sleep.—These nsitive plant, the tamarind tree, and many other plants, close their leaves at a certain period of the day, and open them at another regular period. Plants are sensible also to the effects of cold and darkness, and at their approach close their leaves and their petals.

If, from these cursory observations on the analogous functions and vital properties of animals and vegetables, in which we have endeavoured not to degrade the one, nor too much elevate the other, it is reasonable to believe, that sensibility exists in the myriads of insects, whose existence is limited to a day, who flit in a sun-beam and are seen no more, will it be absurd to hope, that it also exists in the majestic oak, which defies the tempest, and whose age is protracted to a thousand years?

In concluding, gentlemen, this parallel description of the characteristics of animal and vegetable life, which has been but too rapidly sketched, I would remark, that it was not attempted with any expectation of fixing the boundary, which marks the line of distinction between the two kingdoms. In prosecuting the undertaking, I confess as sincerely as gratuitously, that it was impossible not to feel an anxiety arising from a conscious inability of giving the subject that interest which its importance demands.

It cannot most assuredly be contemplated with indifference; and perhaps the oftener it is reviewed, the more extended will be our knowledge of those laws, by which the author of Nature regulates the operations of animated beings. But however limited and imperfect may be our present views of creation, to a benevolent mind it is, and must be, a constant never-ceasing source of consolation to reflect, that "all nature teems with life;" and to the humble and devout, one of his noblest employments, to

"Look through Nature up to Nature's God."

THE END.

ARTICLE VI.

A

DISSERTATION

ON

FEVER.

By JAMES JACKSON, M.D.
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Read at the annual meeting, June 3d, 1818.

I AM not willing to pass by the opportunity of addressing you, my friends and brethren, without availing myself of it to congratulate you on the flourishing and prosperous state of our Society. It is not that I wish to excite any vanity on this subject; but it will give us new ardour in promoting the important objects of which we have the care, to contemplate the benefits which are resulting from that care. It is our business to promote the improvement and extension of medical science. But this, I do

not hesitate to say, is the least important part of our business. We have also to exercise our knowledge and discretion, and to employ our influence, in order to guard our fellow citizens from deception by those, who are pretenders only to the art we profess. To us it belongs to guard the gate way, by which men enter our profession. This is a most important duty. It is a duty which naturally attaches itself to every well-informed and respectable physician, for the very reason that it cannot be so well performed by persons in any other line of life. Individuals however may be discouraged from performing this duty by a belief that their influence will be very limited; and by an apprehension that in some cases their conduct may be attributed to unworthy motives. No such objections can arise from a regular association of all the respectable members of the profession in any district or country; and from such an association therefore, when pursuing this great object firmly, yet discreetly, the happiest effects may ensue. In other countries various attempts have been made for this purpose, but with very limited success. In no place within my knowledge have effects been produced, even in much longer periods, at all comparable to those, which have resulted from the happy system adopted by this society since their re-organization in 1803.* It

* See Note A.

remains for us only to pursue our path steadily; and, as fast as the state of our country will permit, to raise still higher and higher the standard of medical education.

While we indulge in these self-gratulations, and stimulate each other to increased exertions, it is not necessary to pamper our vanity by the pretence, that we claim a high rank among other medical institutions, among the learned societies of Europe, in the improvement of medical science. Considering the nature of our institution, we may feel sufficient satisfaction, if we take the measures necessary to ensure the extension of the solid and useful medical knowledge, which already exists in the world. It is only one man in an age, perhaps, who makes great and brilliant improvements in any science. It is only from select associations, formed in large and prosperous cities, that can issue rich streams, fraught with constant improvements in the details of our art. Societies like ours may make occasional and respectable additions, but not regular and stated contributions, to the mass of science already existing in the world. The reasons for this are too obvious to need to be explained. Yet individuals should always bear in mind that habits of exact observation, of careful research and patient reflection, may enable each one to do something; or at least may prepare him, if opportunities occur, to avail himself of them. True knowledge is a precious

metal, which will always command its value in the market, if exhibited in a proper form. The ore may always be found by those who labour sufficiently to procure it. It often may be found in rich beds under the ground, which we walk over most carelessly; and the man who will have the industry to raise even the smallest quantity from its depths, and to separate the pure metal from the viler matters with which it is compounded, may be assured of obtaining for it its full value.

But it belongs to me to fix on some particular topic of discourse, instead of descanting on the general concerns of our Society, or of the profession at large. For this topic I have selected Fever. It is not without some hesitation that I have selected this subject, since it is one so often discussed, and one, on which the world seem destined never to agree. Yet it is so interesting and so important, that it will bear perhaps better, than any other subject appertaining to our profession, to be brought frequently under review. You will not of course suspect that it is intended to go into a full discussion of a disease, on which so many volumes might be written. On the contrary, it is only designed to throw out, in a form not very systematic, some general remarks, and to point out some distinctions, the tendency of which may be to render our ideas respecting this malady more definite.

SYDENHAM appears to have a good practical familiarity with fevers; and he saw that they presented themselves under very different modifications, yet with so much of a common character, as to be recognized as the same disease. He was not able, however, to analyze the cases of this disease, so as to arrange them under any classical divisions. He was disposed to consider every new epidemic as a new species of fever; and it would seem as if he saw nothing common to these various species of fever, except this, that all were marked by agitations of the living system, arising from efforts to expel some offending matter.

BOTH before and since the time of this justly celebrated physician others have attempted various arrangements, under which they might comprehend all the cases of fever. Yet no such arrangement has hitherto obtained even general approbation, much less universal assent, except that division which relates to the form, or type only, and not to the essential nature of the disease. It is certain however that we do see very wide differences between cases of disease, which all would recognize as cases of fever.— Why cannot these different cases be arranged under different species and varieties? Is the difficulty founded in the want of patient attention, or in the want of sagacity among men, or in the non-existence of distinct species? It cannot, I think, be charged to either of the two first

causes. No subject perhaps has been more patiently investigated, and none by men of greater sagacity. But these men have too commonly commenced their investigations under a persuasion that distinct species of fever do exist, although they could not discover the diagnostic symptoms which mark them. That this persuasion is wrong, and that distinct species of fever, except as to type, do not exist, is proved to me by this, that whatever characteristics you select as the distinguishing and peculiar signs of one species, you find these gradually becoming more faint and indistinct in a series of cases; and you find them at last disappearing under the symptoms of what you would consider another species. I hold then that fevers cannot be arranged in different species, because nature has not constituted them.

We may find strongly marked lines of distinction between particular cases; but intermediate ones are found so gradually changing from each of them, as to leave, at every point of comparison among these intermediate cases, shades of difference only, and not to permit lines of generic or specific division to be drawn at any one point. It seems necessary then to designate the characteristics which are most frequently prominent in fevers, and to consider the cases marked by each of these to be varieties, in a practical point of view, without ever losing sight of the

truth just stated, that proper species are not known to nature.

With a view to explain the opinions I hold on this subject more fully, I shall inquire very briefly what are the characters of fever and its varieties; and on this inquiry I shall ground some remarks on epidemic fevers. I shall then suggest some rules for investigating the characteristics of particular epidemics as they may rise; and shall offer a few hints as to the principles, which should govern us in the treatment of such epidemics.

What are the characters of fever? By this term I do not mean simply vascular excitement, nor heat, nor thirst; but I mean that disease, which by many authors has been called idiopathic fever. It is not the intimate nature of this disease, which is proposed for inquiry, but its characters; the circumstances and appearances by which it is known.

It is a principal characteristic of fever, that it is a disease of the whole system. That it is so must be admitted, although the whole system is not affected in every instance, and although it is very seldom affected equally. It is to be considered a disease of the whole system, because there is not any part of the system which, is not liable to be affected by it; and in most cases every part is affected in some degree; and because the observations of pathologists afford no reason to believe that there is any one part of the body, or any subordinate system, in which the

disease usually commences, and to the affection of which its phenomena can be referred.*

Persons afflicted by fever have all, or nearly all the functions deranged; but not uniformly in the same mode. A careful attention to the phenomena seems to me to show, that an affection of the vital powers, rather than a derangement of the functions, is the immediate or primary effect of the action of the remote, or noxious causes. The derangement of the functions must indeed immediately follow an affection of the vital powers, since it is by possessing these powers the organs are enabled to perform the functions; and this derangement must be modified according to the force with which the predisposing and exciting causes act, according to the constitution and previous state of the subject, and according to various accidental causes, operating upon him at the time of the attack and subsequently. In some instances one and in others another of these causes will have most effect in modifying the disease. When the predisposing cause acts with little force, although many persons in the same vicinity be exposed to it, few persons will be affected; and the disease will perhaps derive its character mostly from other and accidental circumstances. When the predisposing cause is powerful, many persons will be affected; an epidemic fever will be produced; and here the pre-

* See Note B.

disposing cause will give so much of character to the disease, as that it will appear under nearly the same aspect in the greatest number of persons affected by it. From the greater prevalence of one or the other of these causes, may no doubt arise many of the varieties of fever.

In the best descriptions, which we have of this disease, it is considered as consisting of paroxysms; and the type, or form of the fever, is derived from the order in which these paroxysms occur. A fever consisting of one distinct paroxysm is called an ephemera. One consisting of two, or more distinct paroxysms is called an intermittent. Fevers, in which distinct paroxysms do not occur, but in which the disease is prolonged beyond the usual period of one paroxysm, are called continued. Although distinct paroxysms are not discovered in fevers of this type, yet pathologists have believed that such fevers do consist of paroxysms; but that these are not distinctly seen, because a second paroxysm begins before the first has terminated, a third before the second has terminated, &c. This explanation has been thought to derive support from the occurrence of daily exacerbations in a large proportion of the cases of continued fever.

This doctrine, that continued fevers, like intermittents, consist of paroxysms, has always appeared to have some foundation in nature; at the same time that, viewed strictly in relation to the facts, it is obviously not true. That is, it is not

true that continued fevers consist of distinct, or perfect paroxysms, similar to those which occur in intermittents. Yet it is true that, setting aside the form or order of their phenomena, continued fevers seem to be made up of the same elements as those, which constitute intermittents. In order to view this subject in a more just light, let us consider for a moment what are the elements, which compose a paroxysm.

A perfect paroxysm consists of four parts, the access, the ague fit, the hot fit and the crisis. All these parts are not found in every paroxysm, nor, when present, do they bear any constant proportions to each other, either in force or duration. Hence, when all are present, one or two of the parts may be so slight in comparison with the others, as to be quite overlooked.

The access is marked by symptoms, which show not only a change in the functions, but a change also in the powers, or vital properties; in as much as external agents do not produce the same effects on the body as in health; and the internal relations between different parts of the system are not maintained as in health.* The most prominent symptoms of the access are lassitude, weariness, indisposition and inability for exertion, a diminution or loss of appetite, and a

* See Note C.

suspension or diminution of all the functions of assimilation and of formation.* In addition it is also noticed, while the symptoms of the access continue alone, that the capillary vessels on the surface of the body are contracted, and probably the same happens in respect to those vessels in the internal parts of the body; while there are symptoms, which seem to denote that the blood is accumulated in and about the heart.

This stage is called the access, because the symptoms which belong to it may often be noticed in different degrees of force, and for a longer or shorter time, before the occurrence of any other symptoms. But the occurrence of a distinct access is often wanting; and the symptoms which belong to it, are also manifested in a great degree during every part of a paroxysm, and during every part of a continued fever, except the crisis, to which it is opposed. In other words, the access does not necessarily commence before the other stages; but the symptoms which belong to it, or some of them, are present during the whole disease, and seem most particularly to constitute it; and they disappear only during the crisis,† which consists in a solution, or subsidence of the disease, and in a restoration of the vital powers to their former state, though not to their former degree.

The ague fit and the hot fit consist of symptoms, which need not be particularly described.

* See Note D. † See Note E.

They are not peculiar to the disease called idiopathic fever, but occur also in other cases, in which extraordinary actions are going on in the living system. They seem to appertain mostly, if not altogether, to the vascular system; and to consist in, or necessarily to attend the efforts, by which the symptoms of the access are removed and those of the crisis are produced. It does not seem that they are in themselves, and necessarily, inimical to life; but the contrary.* They may sometimes occasion death, but it is only in modes, which may be called accidental.

If this brief analysis of a paroxysm of fever has been correctly made, it will I think be evident what should be said respecting the doctrine that continued fevers, as well as intermittents, are composed of paroxysms. Of perfect and distinct paroxysms the former certainly are not composed. But they are composed of the same elements, which enter into and constitute the paroxysms of intermittents. This is the similarity which has been so often adverted to by physicians, without its having been pointed out with sufficient distinctness.

Regarding fevers as constituted in this way, we are prepared to distinguish more satisfactorily some of the varieties, which are constantly noticed among them. These are such as depend on the comparative prominence of the

* See Note F.

symptoms of some one or two of the elements of a paroxysm. For instance, when the symptoms of the access are most prominent, the fever is what has been called nervous. Accompanying the access and belonging to it, there is often great coldness; but if a proper ague fit, shivering, shuddering, rigor, and horror take place, the hot fit almost universally and perhaps always ensues. The symptoms of the ague fit are however sometimes severe, and continue for an unusual time with those of the hot fit. In this case the ancients gave to the disease the epithet *epialos*. When the hot stage is especially violent, the fever has been called either ardent or inflammatory according to particular circumstances. If the depression of the powers is uncommonly great, and especially of that power which has been called vital affinity,* the fever has been called adynamic and putrid.

We see then that, independent of the varieties of fever marked by differences of type, there are varieties dependent on the preponderance of one, or more of the elements, which constitute the disease. It is obvious that the varieties, which may arise from differences in the relative proportions of these elements to each other, are very great and almost endless. There is still a distinction of another kind, which it is impor-

* See New-England Journal of Medicine, &c. Vol. V. p. 15.

tant to notice, as explaining one class of the varieties of fever. This distinction is founded on the unequal affection of the system in fevers.—Although fever is a disease of the whole system, yet one part, or one subordinate system may be much more powerfully affected than others, and one part may perhaps be altogether exempted from the disease. Hence the distinctions of gastric fever, cerebral fever, &c. Here again, although a predominance of disease sometimes in one and sometimes in another part of the system be unquestionably proved, we cannot follow those nosologists,* who attempt to divide the disease into species, by reference to the part of the body, or by reference to the texture of the parts, principally affected. Inflammation may be distinguished on this ground very well; but in respect to fever, this is never wholly confined to any one organ, nor to any one texture; and although it affects the system unequally, its inequalities are marked in different cases by such slight gradations, that we cannot find a place, at which a line of distinction can be drawn.

Fevers sometimes terminate in death, and that at various periods of the disease and in different stages of a paroxysm; and they sometimes terminate in health. They usually terminate in health by a crisis, more or less distinctly marked. But they also terminate in other dis-

* Such as Pinel in his nosographie philosophique.

eases; and also in frequent instances have other diseases combined with them. These diseases, in which they terminate, or with which they combine, are inflammation and hæmorrhage. The irregularity and increased danger of the disease, when this combination of local affections with fever takes place, have occasioned cases, in which they occur, to be called ataxic and malignant. I know the objections, which lie against the doctrine of a combination of diseases; yet regarding these diseases not in relation to their causes, and not in relation to their intimate nature, but in relation to their symptoms, or external characters, they must be considered as distinct diseases existing in combination, since each of them may exist separately; and also because one may subside and the other continue alone.

In some cases of fever it would seem as if an inflammation were attempted, but not effected. At least there is found the same fulness of the blood-vessels as in inflammation, with a consequent embarrassment or even suspension of the functions of the part; but none of the processes of inflammation take place. In these instances there is said to exist a congestion of blood in the part so affected. The symptoms of this congestion in combination with fever, require to be carefully distinguished. One important variety of fever is constituted by this combination.

This variety, if we regard the symptoms which belong to it, may be considered as inter-

mediate between that of inflammation with fever and that of unequal affection of the system by fever; and thus by gradation even this most important distinction between simple fever and fever combined with inflammation, is almost destroyed.

It would seem then that the grounds, on which different cases of fever may be distinguished, are of four descriptions; first, in respect to type, and, while fevers resemble each other in type, they may differ in almost all the other respects, which have been mentioned. Second, in respect to the proportion in which the different elements of a paroxysm are present. Third, in respect to the organs or subordinate systems which are especially affected. Fourth, in respect to local affections occurring in, or being combined with fever, those affections differing in their nature from fever itself. Perhaps the varieties of the third and fourth kinds should be included under one head; but as this is not certain, I think it better to separate them. Future observations may decide this point.* All these varieties, except what relates to type, may be seen in the course of a few years of ordinary practice in almost every situation, where a number of men are collected together; and that, whether the population be compact, or scattered. They will however be discovered most readily, when fever is epi-

* See Note G.

demic, and when therefore there are opportunities of comparing many patients at the same time.

We are told that all the cases of an epidemic resemble each other; or at least that there is a prevailing character, which is developed more or less perfectly, in every case of an epidemic. It was in following this opinion, Sydenham seemed to consider every epidemic fever as a distinct species; and hence he thought that it was easy to discover one mode of treatment, which should be applicable to all the cases of an epidemic and not to those of any other. That something like this may be true in respect to the majority of cases of an epidemic may be safely admitted; but these doctrines have been carried too far, and have led in many instances to the adoption of an uniform mode of practice in epidemics, which has been injurious. They have led others also, as they led Sydenham, to believe that all past experience was useless in respect to a new epidemic, and that this is always to be studied as a new disease. It seems to me that the experience of almost every extensive practitioner of medicine, when carefully reviewed, will support me in what has been stated in respect to the varieties to be observed in the same epidemic; and that the very persons, who maintain the doctrines opposed, do in many instances give evidence against them. You can scarcely turn to the description of a single epidemic fever, given by a faithful eye witness, in

which the writer, after describing the disease under its most common appearances, does not tell you that there was another class of cases, which differed very considerably from the first. Sometimes even three or four classes are mentioned, or else it is said in general terms that the disease appeared under a great variety of characters. Even in respect to type, varieties are sometimes seen in the same epidemic. Intermittents and remittents are often seen together, and so also remittents and continued fever. Likewise the ephemera is found to occur in the same epidemic with continued fever. But in looking to other characteristics than those of type, you will perhaps always find varieties in the same epidemic. Most of the cases in one epidemic shall be simple fever, yet there shall be some in which inflammation or hæmorrhage shall take place; or, on the contrary, one of these latter shall be combined with fever in the majority of cases, but there shall still be many, in which this combination does not exist.

In one epidemic, the symptoms of the access shall be very severe in most of the cases; in another those of the cold fit; in another those of the hot fit; and in another those of the crisis.—Meanwhile in each of these epidemics there shall be cases, differing from the rest in the very points, for which the majority are the most remarkable.

Some epidemics are characterized by the unequal affection of the system under fever. It is the brain and the parts connected with that, which are most deranged in the majority of instances in one epidemic; the gastric system in another; the heart and circulating system in a third; the secretory and excretory systems, or the system of small vessels in a fourth.—But, in each of these epidemics cases will occur, which might be classed under each of the others.

The general principle which I wish to state then is this; although each epidemic fever has its prevailing character derived from the majority of cases, yet there is a considerable variety to be found among those, which belong to the minority. This variety is undoubtedly greater in some epidemics than in others. When the epidemic disease is extremely violent, as often happens at the commencement of its prevalence, the cases are commonly found to resemble each other the most strongly. This circumstance may probably be explained in a manner formerly hinted at. But in proportion as the disease lessens in violence, or at least in proportion as the predisposing cause acts with diminished force, the influence of constitution, habits and exciting causes tend to modify the disease in the subjects whom it attacks.

Indulge me for a few moments in making some application of these remarks to the two

great epidemics of our own country, which have been called yellow fever and spotted fever.

The records which we have of the yellow fever show us that,

1st, in respect to type, many of the cases were remittent, but more of them continued.

2d. In the largest number of cases the hot stage was violent; but in some instances the access and the cold stage were most severe and the greatest danger arose from them.

3d. But principally in this epidemic inflammation existed with fever, either at the beginning, or during its course; and the great danger of the disease arose from this combination. The inflammation was not however limited to any one part of the body. In most instances it affected the abdominal viscera, sometimes the liver principally, sometimes the stomach. But in others it affected the brain, and, if I mistake not, in some it affected the lungs.

4th. In some cases petechiæ showed themselves in the course of the disease; a circumstance scarcely necessary to be mentioned as evidence that these appearances are not peculiar to any one epidemic, or to any one species of fever. It may be added that the yellowness of the skin and the black vomit, which occurred in many cases of this epidemic fever, are referable to the affection of the abdominal viscera. They are

not therefore pathognomonic symptoms of the disease.

In the petechial fever there were observed, 1st. a few cases of ephemera, although generally the disease was of the continued type. Where the type was continued, the disease was most severe at the first attack.

2d. In the beginning of the disease the symptoms of the access and those of the cold stage occurred suddenly, sometimes together; they were extremely violent and frequently continued for an unusual time and even destroyed life; the hot stage was often almost wanting, or very mild; the tendency to crisis was much stronger than in common continued fever. If the disease went beyond one paroxysm, it often assumed a much milder character, the symptoms of the access being reduced in violence, but yet continuing, and being mixed or alternated with those of the hot stage.

3d. In many cases, and that especially when this epidemic first made its appearance in any place, there was combined with fever an affection of the brain. I conceive that this affection was oftentimes only a congestion; but that in not a few instances it was an inflammation of some part of the encephalon, accompanied by great congestion. Probably most of the fatal cases were those, in which the brain was violently affected.

4TH. In some persons petechiæ appeared, and in others eruptions on the skin took place; but in very numerous instances these were wanting, and in some places and seasons altogether so. All these appearances were referable to a disposition to cutaneous inflammation.

5TH. There were also cases, in which the lungs were inflamed, a very few in which the stomach was inflamed and black vomit took place, and others in which the joints and other parts were inflamed.

THE appearance of prostration, which was so much noticed in this epidemic, surely did not arise from a real debility, or loss of power. It was the same, which is seen always in fever; it was the most characteristic symptom of the access, which in this epidemic was violent and comparatively long continued. It was also aggravated in many instances by the suspension of the animal functions in consequence of pressure on the brain.

I AM aware that a much greater detail and a more precise statement of facts would be necessary to give satisfaction to all who hear me, and to induce them to adopt the opinions advanced on the subject of epidemics. It is not possible, however, to do more on this occasion than to explain my own opinions, and I would rather leave others to the evidence, with which reading and observation will, as I believe, be constantly furnishing them. Meanwhile to connect what has

been said on this subject, it may be remarked, that, if my observations respecting epidemics be correct, they go to confirm the doctrine that a rigid classification of cases of fever cannot be made.

Do the opinions and principles which have been advanced, lead to any practical advantages? In reply to this question, it may be said that, if they lead to a more just estimate and discrimination of the phenomena of diseases, they cannot fail ultimately to be of practical utility.

But it will not be difficult to point out very positive advantages, to which these principles will lead. If they be correct, they lay the foundation for general rules to be observed in treating all epidemics; and these rules such as may be drawn from experience in past epidemics, and such as shall be applicable to individual cases. It will not be possible at this time to do any thing more, than to point out very generally how these results are to be attained.

First, the physician must study the phenomena of fever generally. He must remark the occurrence of these phenomena in paroxysms; he must, as a model, study a perfect paroxysm, noticing the characteristics of its different stages when most distinct; he must then learn to distinguish these different parts, elements, or stages of paroxysms, when they occur in fevers without regular order, and not in succession. If

he find that every case of simple idiopathic fever is constituted of some of these elements, although each case does not exhibit the presence of all of them, he is better prepared to distinguish the varieties of this multiform disease. He is also to bear in mind that the disease has varieties grounded on other circumstances, of which some at least have been referred to in this discourse.

Second, the physician must constantly have in mind the occurrence of local derangements, in addition to the general derangement, in fever; arising principally from congestion, hæmorrhage and inflammation. These local derangements he will find to disturb the regular order of occurrences in fever and to increase the danger, and hence to justify the epithets ataxic and malignant, which have been applied to the cases in which they take place.

Third, having learnt to distinguish the elements, of which fever consists, he will learn to distinguish those, which are present in any individual case of fever, and to ascertain the relative force and importance of them. He will learn from which of these the greatest danger arises, and direct his remedies to the removal or diminution of that part of the disease; at the same time that he will employ, so far as circumstances permit, the remedies adapted to the removal of the whole disease. In general, however, it will be found that when that part of the

disease which is most violent has been removed, the remainder will readily and easily subside; or, if not readily, at least safely.

Does it happen for instance that a case presents only the symptoms of the access of a paroxysm, or these principally; however much the character of the epidemic may authorize the fear of great vascular action, or of inflammation, the practice should be to stimulate the various surfaces so as to excite action in the extreme vessels, both on those surfaces and by sympathy in the heart. The stimulants employed must be of such strength as the case requires; but, so far as possible, the purpose should be effected by such, as are least permanent in their effects, and by such as induce secretions and excretions at the same time that they induce vascular action. Heat therefore, and most especially heat combined with moisture, is one of the best remedies in such a case.

But in these cases it occasionally happens that something more is to be done. For, as has been stated, in a severe access there is sometimes great oppression about the præcordia and obvious embarrassment of the heart; and, as the blood has left the small vessels, we may well believe that this fluid has accumulated about the large vessels and perhaps in the heart. The stimuli applied induce the heart to make such efforts, as will relieve it from this pressure; but though this is their tendency, they do not always suffice.

If this difficulty exist, it is proper to relieve the heart from the pressure of blood by evacuation. This indeed must be done with a cautious hand. It is not proper to draw a pound of blood at once in such a case; but it is useful to draw a small quantity, for instance three or four ounces, while the stimulants are still employed; then to rest a little, but in a short time to open the vein again, and thus repeatedly to abstract a small portion of blood until the action of the heart becomes free. When this has been effected, it may, or may not, be proper to take away this fluid in a larger quantity, according to the circumstances that ensue.

It may not often happen that the symptoms of the access, or of any stage continue for a very long time, without a mixture of those of other stages; for in the ordinary course of things, the system when affected by fever is almost constantly going through changes, or passing from one stage to another. But yet it very often happens that the symptoms of some one stage predominate, that the danger arises from this source, and this danger can be opposed only when the proper discrimination is made. It still oftener happens in severe epidemics, that the danger arises from inflammation, hæmorrhage, or congestion, and that this danger is to be obviated only by relieving the organs affected from undue pressure. It would be interesting to advert more fully to this part of the subject, and to consider

the methods, sanctioned by experience, of overcoming the dangers from such local affection; but this would lead me to trespass too far on your time. I shall then only express my conviction, that ordinarily these dangers are not to be removed without the use of the lancet. The considerations, which should decide how frequently blood should be drawn, and to what extent, would of themselves form an ample subject for another discourse. Allow me to state generally that, where important organs are affected by inflammation combined with fever, the danger is vastly greater and more pressing than when the same parts are affected by inflammation alone. The disease commonly destroys life by the interruption of the functions of the diseased part and by aggravating the violence of the fever. In such cases nature sometimes gives relief by suddenly instituting some great evacuation, and producing resolution in the inflamed part. The only safe practice is to imitate this method of nature. Blood-letting is preferable to other evacuations, and is more to be relied on in such a case; 1st. because the disease is vascular; 2d. because this evacuation is attended with less fatigue and distress to the patient, and with less injury to the great organs of his body than any other; and 3d. because in this way only can we be sure to make the evacuation sufficiently copious and sufficiently quick. Blood should be drawn until the inflamed organ is relieved.

This must be the criterion; we are not to consider the state of the pulse, nor the state of the blood, but the sensations of the patient and the functions of the diseased part. At the same time the remarks already made should be referred to; viz. that it is not while the symptoms of the access are predominant that this practice should be adopted. Likewise it may be added that the patient may be supported by cordials, if the case require it, while this system is pursued.

When this treatment is adopted and the local disease is removed, the fever will generally assume a mild character and will shortly terminate in a crisis. That the patient will at once recover strength, after such a mode of treatment, cannot be expected. The treatment is adopted to save him from the most imminent danger to his life, and in such a case it is comparatively of little moment, whether his convalescence be protracted for a few weeks, or even for a few months. But experience does not show that the debility, which follows this mode of treatment, is so great as might be apprehended. If the system be speedily relieved from disease at its commencement, and it is only then that this practice should be adopted, the recovery is oftentimes as rapid as after the mildest fevers. If the treatment be bold and the relief be perfect, the risk of protracted debility is seldom realized.

Such is the outline of the advantage to be derived from regarding the phenomena of fever in the manner which has been proposed; and I will conclude with a single remark.

If these views be not correct, yet, in as much as they would lead us to attend minutely to the phenomena of fevers and to arrange these phenomena in distinct classes, so they would in some measure supply the place of a division of fevers into species, and would also lead us with greater certainty, ultimately to discover whether any such division could be made.

NOTES.

Note A. p. 187.

In part to justify the assertions made in the discourse, but in part also from a sincere desire to make known the simple, but effectual system adopted by the Massachusetts Medical Society, I shall offer a brief exposition of that system and state its actual effects.

This society, like most scientific and literary institutions, was originally designed to be composed of a select number only; and it was presumed that the honour of an election into it, would be an object of emulation among all young physicians. The members, who composed it from its establishment in 1782 to its re-organization in 1803, were the physicians of the most prominent character in the commonwealth. There was among them men, who were deservedly honoured for their scientific attainments, and many who were most justly esteemed for their professional acquirements and skill. But in so young a country, in which the ardour of science could not derive support and encouragement from surplus wealth, it was not to be expected that this society would become distinguished among the learned. Its members were too busily engaged in their daily practical duties, each in a limited sphere, to occupy themselves in great scientific labours. They were not however negligent of the opportunities which occurred to them, as was shown by the publication in 1790 of the first number of their communications.

THE number of Fellows was originally limited to seventy. The society was authorized to point out a mode of education for medical students; and it was obliged to appoint censors, whose duty it was to examine students who should apply to them; such students having pursued the method of education pointed out. Students, who were approved by the censors, received letters of license to practise medicine and surgery. In some instances, candidates for practice availed themselves of this opportunity of proving their qualifications, but the number was comparatively very small. It may be added that during the period referred to, there were some, they also few in number, who received medical degrees from the University at Cambridge after having complied with the requisitions of the medical institution there. In the great majority of instances however young physicians engaged in business without any recommendation or license from a publick body, and without having complied with any regulations as to the term or mode of education. It must be presumed that many of them were very imperfectly qualified for the important duties of their profession.

IT was obviously a great object, to compel, or to induce medical students to give satisfactory evidence of their qualifications before commencing professional business. But it was believed that this object could not well be effected in any country by positive law; and certainly not in this country, where the citizens are so justly jealous of their rights. No law could effect the object, the operation of which might not be extended to the interruption of the kindest offices of charity. The people must always be permitted to seek relief wherever they please; and their confidence will be limited to the regularly initiated, only when they are satisfied that none others are equally worthy of it. The great object must be effected then by influencing public opinion; and this could not perhaps be so well directed in any way, as by the actual members of the profession.

WITH the views, which have here been briefly sketched, the society applied to the legislature of the commonwealth in

1803 for an alteration of its charter, and this was granted. By this they were permitted to enlarge their number indefinitely. It was also provided that all persons, who should become licentiates of the society, or medical graduates of Harvard University, after the date of the new law, should be entitled to claim admission into the society. The only requisites were, that they should first spend three years in actual practice within the commonwealth, and that they should be of good moral character.

The society now proceeded to elect to fellowships all respectable physicians within the commonwealth as fast as they became known to them. Thus all, who were actually in practice and in good repute, were made to take an interest in the society; and this they were the more encouraged to do by certain privileges granted to its fellows by the new act. At the same time it was known, that in future the mode of obtaining an admission was to comply either with the bye-laws of the society in respect to education, or with the statutes of the university, so as to become entitled to the honours of one of those institutions. Lest the desire to obtain the advantages of a fellowship of the society, which would be a distant good, should not operate sufficiently on the candidates for practice, another and that a most important measure was adopted. The society passed a bye-law, forbidding any of its fellows to consult with, to aid or to assist in any way, any medical practitioner, who should enter his profession after the passage of said bye-law, without having obtained a license from the society, or a medical degree from the university. Thus a candidate for practice, who has not obtained one of these, must be discountenanced by the respectable members of the profession, and of consequence, it is presumed, by the public. Thus there was an additional and commanding inducement given to young men to acquire a proper education.

It must be obvious that the effects of this system could not be seen immediately. They were to be manifested in the generation which was to rise up after its adoption. Also it was not enough that the regulations were adopted; they must

be practically enforced. Inconveniences would arise, as under every new system. Time and experience only could teach the methods of obviating these. The period however has now arrived, at which we can speak of the effects of this system; and these I shall state with accuracy and fairness.

First, there has taken place a great change, throughout the commonwealth, in respect to the value placed on regular medical education. The public, the citizens generally, have become much more solicitous to learn whether young physicians have duly qualified themselves for their professional duties. The citizen will judge for himself respecting the natural sagacity, the good judgment, the prudence, the firmness and the moral character of his physician; but respecting his professional education the citizen cannot judge, and of that therefore he demands the regular credentials.

Second, the increased and more general attention to medical science has operated upon students. Their zeal has been excited, and they are more solicitous to be duly instructed. The instruction is not only necessary as a passport to practice, it has become necessary to every ingenuous and intelligent youth for his own satisfaction. The pupils no longer understand that it is enough, if they learn what one master can teach, or if they get the mere routine of his practice; they have discovered that they are to excel their fathers.—With a most generous enthusiasm their fathers encourage them to do so; and only lament that the change had not happened at an earlier period.

These are not exaggerations. The change within only fifteen years has been most manifest. It is not that medical science itself has received great improvements among us; not indeed that we have failed to do in that respect the little that could be expected of us; but the change is in the greatly increased diffusion of the fundamental principles of our art. It is not pretended that our education is better than in many other places, nor even so good as in some others. But many more enjoy its advantages. It is not so easy among us, as in most other parts of the world, either in Europe or America,

for a physician to engage in business, without certain necessary qualifications. Our standard is perhaps nearly as high as the state of society will bear. I trust there is a disposition to raise it, as fast as the general advance in wealth and intellectual improvement will permit.

It must be confessed that the system, which has been described, has not been introduced into every part of the commonwealth; and that it has not been established equally in every part where it has been introduced. In the central and more populous districts it has been firmly established for several years, and in these districts the good effects are becoming more and more manifest. In the remote districts, and in places where the population is greatly scattered, it has scarcely begun to get established. In these however its influence is becoming known, the real nature and operation of its provisions are now understood and duly valued by the most intelligent physicians, and efforts are making for the introduction of it. These efforts will succeed; and wherever the system is once introduced, it will maintain itself as long as there are any intelligence and any virtue in the community.

Note B. p. 193.

I am not ignorant of the many attempts of pathologists to prove that all fevers are secondary, arising from the local affection of some part of the body. Different organs have been fixed upon by different theorists; at the present day there seems a tendency to the opinion, that there is not any one organ which is always affected in the fevers, which have been considered idiopathic; but that any organ, being affected, would produce the general disease; and that there is always some local affection, which acts as the immediate or proximate cause of fever. I shall not offer the arguments against this opinion, but remark only, that the burthen of proof lies properly on those who maintain it, and that they must offer some explanation of the cases, in which the morbid anatomist has not been able to find any local derange-

ment, or certainly none of importance, in the bodies of persons, who have died of fever. It may however be observed *en passant*, that some physicians have been so desirous to prove that local inflammation causes the disease called fever, as to admit almost any extraordinary appearance, however slight, in the dead body, to be evidence of the previous existence of inflammation. Having once established the existence of inflammation in any degree and to any extent, they proceed upon the hypothesis that the same constitutional effects may be produced by a slight and very limited inflammation, as by the same disease when extensive and violent. It will appear in the sequel that I attribute much importance to inflammation when occurring in fever. But upon that point I may here remark, that, while inflammation, or a local vascular disease, in an important organ, may add much to the danger of fever when the former is superadded to the latter, it does not follow, that every such local affection is capable of producing all the constitutional derangement which we see in fever.

Note C. p. 195.

It is obvious that a given external agent will produce uniformly the same effect on the living body, if the state of that body be uniformly the same. But trifling deviations are always occurring in the living body, and hence trifling differences are to be noticed in the effects of external agents. In fever, and especially when the symptoms of the access are manifested, the effects of external agents differ greatly in kind and degree from those of health. Hence it is inferred that the vital powers have undergone a change. Again, as the internal relations are maintained by the vital powers, if these relations be not maintained as usual, we are authorized to suppose that those powers are affected.

Note D. p. 196.

By the functions of assimilation are meant all those, which are subservient to the formation of blood from the nutriment

taken into the living body. By the functions of formation are meant those, by which either solids or fluids are prepared from the blood to be used in the body.

Note. E. p. 196.

THE term crisis is used here in the restricted sense, in which it has been employed by our best modern authors, particularly by Fordyce. It means a favourable crisis, the characters of which are that the phenomena of health reappear, accompanied by certain unusual motions and evacuations.—These evacuations seem to be produced by the causes of irritation, which had accumulated in the body during the disease, but which had not produced much or any effect, because the vital powers had been in a morbid state, but which do produce efforts in the excretory organs as soon as the powers are restored to their natural state. Thus, when the intestines recover their natural irritability, the matters which had accumulated in those organs will induce diarrhœa.

Note F. p. 197.

THOSE, who consider the cold fit, the hot fit, and the crisis, as alone constituting fever, have always been prone to regard fever as a salutary effort of nature to remove something inimical to the living system. It certainly does seem that the cold and hot stages of the disease have *a tendency* to work some salutary change, since they *tend* to induce a crisis, under which the first morbid appearances subside. I say, *a tendency*, since they do not uniformly have the effect to induce crisis, and in continued fever the hot fit is repeated many times before crisis is produced.

Note G. p. 200.

WILL it be contended that I really divide fever into different species? It may be well here to answer this objection,

which a superficial view of the subject may suggest. I admit varieties, but except as to type, I contend that idiopathic fevers cannot properly be divided into species. This is not a verbal distinction. The distinction of species is acknowledged by nature in respect to all her productions, and is always well marked in every individual, acknowledged monsters only being excepted. The distinction of natural objects into classes, orders, and genera, is arbitrary, and though grounded on natural marks, is not properly a distinction made by nature. Accordingly there may be a difference between two systems, equally good in the distribution of the objects of them into classes, orders and genera; but they must agree as to species. On the other hand varieties as well as species are acknowledged by nature, but those do not differ by essential marks. Species include varieties; and these differ among themselves in different degrees, or by gradations, so that some shall more nearly approach the common standard and others less nearly. But if we would mark every degree of variety, we are brought to the discrimination of individuals. It is in this sense I contend that varieties may be found among idiopathic fevers, but not species, except as to type. This undoubtedly enables us to divide fevers into species, but it is still to be borne in mind, that the distinction relates to type only; and that there is the same or nearly the same variation among fevers of one type, as among those of another.

THE END.

Dec. 9, 1857. Gift of Dr. N. B. Shurtleff

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VOLUME III.—PART II.

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1822.

ARTICLE VII.

A EULOGY

ON THE CHARACTER OF

JOHN WARREN, M. D.

President of the Massachusetts Medical Society, Professor of Anatomy and Surgery in Harvard University, A. A. S. &c. &c.

BY JAMES JACKSON, M. D.

Professor of the Theory and Practice of Physick in the University at Cambridge, Fellow of the American Academy of Arts and Sciences, of the American Philosophical Society, &c. &c.

Delivered April 8, 1815.

THE feelings which have been manifested by the publick, at the death of Dr. Warren, are sufficiently lively. I need not, my friends, ask you to mourn; I need not attempt to rouse your sensibility. Engaged, as I am, in active life, and unpractised in oratory, I am induced to appear before you on this melancholy occasion only by veneration for the character of my late excellent colleague, whose remains lie before you.

The Massachusetts Medical Society call on me to express their respect for our deceased President; to say how much they valued him when living, how much they delighted in doing him honour. In expressing their feelings, and my own, it is needless to study the language of panegyrick; it is wished that I should employ only that of simplicity and truth.

It will be praise sufficient if, in detailing the history of the deceased, I can exhibit his conduct in its true colours; if, in briefly analyzing his character, I can describe to you the elements which composed it, as they existed in life. It is esteemed lawful to magnify the merits of the dead: but this is a privilege of which we need not avail ourselves. The unexaggerated description of this eminent physician, must be sufficiently honourable; else why was he beloved and respected during a long life by all classes of his fellow-citizens? why regarded by our University as peculiarly qualified to give most important instruction to her sons? why elevated by our Medical Society to its highest office, and solicited to remain there, as conferring dignity, not as receiving it? The truth must be sufficiently honourable, for after passing nearly forty years among you his character cannot have mistaken; and how that character has been estimated is very fully demonstrated by this assembly,—has been most

unequivocally declared by the general lamentations during the past week.

Dr. John Warren was the son of a respectable farmer in the town of Roxbury. The father died while he was almost in infancy. He entered Harvard College in 1767, then just fourteen years of age; and while there he ranked among the first scholars of his class. It is probable that he had already made choice of his profession; for some of his contemporaries recollect with great pleasure that he took the lead in a college-club established for the study of anatomy. He was graduated bachelor of arts in 1771, and passed two years, at that time the customary period, in the study of medicine under his brother Dr. Joseph Warren. That brother was then engaged in extensive practice in this town, and was of very high standing in the profession. Some of our older citizens still remember with gratitude the services he rendered them. But in the present day, and to the world in general, he is known as the patriot and the soldier; as one of the first among those who pledged every thing in the cause of his country at the commencement of our revolution; and as having been the first of its distinguished citizens, who was called to redeem that pledge with his life. His memory will live until the history of our nation is forgotten among men. Within these same walls, and precisely thirty-nine years from this day, was his eulogium

pronounced, amidst the tears of his fellow citizens, on the re-interment of his remains.

In 1773, Dr. John Warren established himself in professional business in the town of Salem. There, among a people accustomed to discrimination, characterized by habits of exact attention and cautious inquiry, the merit of this young candidate for their favour was duly appreciated. There he was associated with the venerable Dr. Holyoke, who now remains the aged father of our profession in that ancient town; and who even then, more than forty years ago, seemed to be growing old by the measure of his services. That gentleman had already shown all the benefits which may be derived from a physician, who is humane and learned, ingenious and faithful. It is extremely honourable to Dr. Warren, that he was so highly estimated in a place, where the standard of medical excellence was so much elevated.

An ungracious temper, a want of tenderness, or want of courtesy may defeat the prospects of a physician, otherwise the most fully instructed in what belongs to his profession. But we all know how opposite to this was the character of our friend. The inhabitants of Salem did honour to themselves in the reception they gave him. So successful was his career that at the end of eighteen months he found himself in very extensive and honourable employment; and probably

he would have passed his life in this place, but for the peculiar circumstances of the times. It was the moment in which our revolutionary struggle was commencing, and when the best men of our country, regardless of the great evils which it was easy to foresee, and ignorant of many others, which experience has since developed, were thinking only of the maintenance of their liberty;—of their birth-right as Englishmen. The ardent spirit of Dr. Warren would not permit him to be idle. Considerations of prudence and of interest, which might have urged on him the hazard of relinquishing a business so prosperous and so promising, these considerations could not retain him at this interesting crisis in private life. He thought only how he could be useful to the commonwealth. He was not forward in making a proffer of his services in a time of inaction;* but when assured that the contest had become serious, on the 17th of June, 1775, he no longer hesitated as to the course to be pursued. That day is well known to you all; it is yet fresh in the memories of many who witnessed, as he did, the great events which were then transacting. But he had a personal excitement at that moment, which others did not experience. Youthful, ardent, and generous, loving true glory, yet alive to every tender affection of domestick life, we wonder not that his mind was

* Note A.

deeply agitated at the greatest sacrifice made by his country in the sanguinary conflict on the heights of Charlestown. The death of general Warren was felt as a great national calamity; yet it was a glorious earnest of the steadfastness of the people, and of their resolution to spill their best blood in the defence of their cause. In the breast of our departed friend, then in the spring-time of life, it may well be supposed to have excited all the same mingled feelings of grief and of pride, of lamentation and of exultation. General Warren was not merely his brother; he was to him a father, a preceptor, and a friend.

On the day following the battle on Bunker hill, nay on the very night, he resolved to devote himself to the publick cause; and, guided on his way by the blaze of Charlestown, with his arms and his knapsack, he repaired to Cambridge and presented himself at head-quarters. It was on the road from Cambridge he met the sad tidings of his brother's death; and it is remarkable that such was the confusion of things, he could not ascertain for several days whether the report was well founded. The state of torture he endured at this period was, in the words of his diary, "such as none who have not felt can form any conception of." In this state of mind he offered himself for the service of his country. He solicited only to be made useful. In the warmth of his feelings he had determined to enter the ranks as

a common soldier; but he came under the eye of one who probably saw that he was made for higher purposes, and he was at once employed in administering to those, who had suffered in the recent battle. His merit and his skill could not pass unobserved, and immediately he was appointed to the honourable and important office of hospital surgeon; an office truly honourable and important, since our young army consisted at that time of the best blood of the nation, of the real strength and flower of our country. For two years he followed the fortunes of our little army, during which he was in the campaign on Long Island, and in the battles of Trenton and Princeton. In 1777, he was appointed superintending surgeon of the military hospitals in this town, and in this station he continued until the peace in 1783.

At this period of his life we find him already distinguished as a surgeon and an anatomist. Made acquainted, by his industry and application, more fully than those about him, with the structure and functions of the various parts of the human body, he had begun, in the year 1780, to give instruction to others. He was the first who gave lectures on anatomy in this town, and probably in New England. These lectures were heard with great delight, and in the following year the students of the University were permitted to attend them. Some bequests had been previously

made to that seminary, the most valuable institution of which our country can boast, for the establishment of medical professorships. President Willard then watched over its interests with a zeal and fidelity which can never be surpassed. That venerable man perceived how much those interests might be promoted by the talents of Dr. Warren, and the result has done the greatest honour to his sagacity. The president proposed to Dr. Warren to accept the office of professor of anatomy; this office was created at that time with a view to him; and he furnished, at the request of the president, the plan for a medical school, which was adopted by the corporation.

Dr. Warren was probably more self-taught than any man, who has undertaken a similar office, within the last two centuries. He had indeed the books of anatomists before him; but he had not like other great teachers of our day, in this country as well as in Europe, had the benefit of personal instruction from any of the great masters in the science. He gave to others the advantages which he had not enjoyed. Every difficulty vanished, which could be overcome by zeal, by industry, and by talents. His lectures were delivered for twenty-six years at Cambridge without any assistance,* notwithstanding the extensive practice in which he was constantly engaged. Before the passage to Cambridge was

* Note B.

facilitated by bridges, and while he had not yet become perfectly accustomed to his annual task, his health at the same time being very feeble, he sometimes faltered—not in performing well the duties assigned him—but in his resolution to retain an office to which was attached so much fatigue of mind and of body, and which occasioned him so much interruption in his professional affairs. Twice he proffered his resignation;—but happily for the community he was dissuaded from his purpose. President Willard knew his worth, and justly deprecated a loss which he could not repair.

By the medical lectures delivered at Cambridge the stock of medical science in this portion of our country was very much increased. The publick became sensible of the necessity of elementary instruction in this mode. But insuperable obstacles rendered this instruction very defective, while it was given within the walls of the University. A medical school can never flourish except in a large town. Dr. Warren was always sensible of these truths. In 1810 he, with his colleagues, effected the extension of the medical lectures to this town; and since that time the correctness of his judgment has been abundantly demonstrated by the increased usefulness and increased prosperity of the institution.

From the year 1777, when Dr. Warren took charge of the army-hospitals in this place, he became engaged in private practice. How extensive that has been, almost from the first moment, scarcely need to be stated in an assembly of his townsmen. Probably no man in America has gone through so much business, I will not say in the same number of years, but even in the longest life.* Certainly for thirty years one would think he scarcely retained time enough at his own command for the common purposes of sleep and refreshment. Yet we find that during this period he always had time to do good in his fullest proportion, as to those concerns which are common to all men. The interests of humanity were always his, and from her call he could never turn away his ear. We learn from the respectable fraternity of Masons, that he was among their greatest favourites, and following his brother he attained, at the age of thirty, to the highest distinction which they could confer on him. In the Humane Society he was one of the earliest and most valuable members, and for many years was justly placed at its head. What, in short, is the institution designed for the promotion of human happiness among us, in which he has not taken an active part? When a useful object was proposed, who has not felt assured that Dr. Warren might be counted among those who would give to it efficient support?

* Note C.

It is well known to our Medical Society, that the services of our late president have been of every description, which could be useful to them, or to the publick. Justice to his memory prompts me to recount those which were most important, and to state how freely they were given; but the time would fail me in the recital. Our older members have seen him performing most faithfully the duties of subordinate offices. The younger have known him only as the president, the magnus Apollo, the soul of the society.

In thus hastily tracing the path of our departed friend, so far as his life was publick, you have seen some of the most prominent features of his character. But how much more was displayed to those who knew him well? Allow me for a moment to approach him more nearly, and to sketch briefly his more distinguished traits. If I can present a picture at all resembling the original, I cannot be tedious. Even the depraved find pleasure in contemplating the excellences of the virtuous dead.

It is not easy to decide whether Dr. Warren was most indebted to nature, or to the diligent use of the rich faculties with which he was endowed.

His perception was quick and acute, his imagination lively and strong, his memory tenacious, his judgment rapid, his actions prompt and decided. One less accurate in observation, less

stored with various knowledge, less instructed by experience, would commit great errours in transacting business as he did. The motions both of his body and mind were the constant subjects of astonishment to those who saw him; and it is not strange that men of slow intellect sometimes hesitated for a moment to place confidence in results so suddenly pronounced.* But he seemed to move most safely and to attain his objects most certainly by pursuing the method which his own constitution required; while the more tardy were surprised, after a full investigation, and by a rout more circuitous, to find at length how precisely his judgment had been correct. This rapidity in all his intellectual operations, and in the affections and motions consequent upon them, constituted a very striking trait in his character. To his ability to perform more than others in the same time, he owed in part the greatness of his acquirements. But he owed them in part also, to his great industry and diligence.

Thus endowed, and thus cultivated, he could scarcely fail to arrive at a very high rank in his profession. Accordingly we find him constantly receiving marks of honourable distinction through life, and always enjoying the highest confidence of those around him. In all branches of his profession he gave evidence that he was well en-

* Note D.

titled to this confidence; but it was in the practice of surgery he attained to the most extensive reputation. In this department of practice he has for many years been unrivalled; and the lame and the blind, from all parts of New England, have resorted to him for relief. With what care and with what tenderness he investigated the nature of their complaints, with what skill and success he performed the most difficult operations, many grateful patients are ready to testify; and to the honour of his heart it should be remembered, that the stranger, who was led to him by his professional reputation, never left him without a love for the man.

His temper was ardent, most affectionate, most generous. Fair and open himself, he learnt to distrust others only from experience. His sympathy, physical and moral, was peculiarly strong. He was liable, sometimes from ill health and always from the afflictions common to our race, to have his spirits greatly depressed. It was not gloom—it was, especially when from moral causes, an affection which had more of passion and more of tenderness. But this affection was never of long continuance, though sometimes violent; for there was a peculiar elasticity in both his moral and physical constitution; and he was quickly restored to that cheerfulness and vivacity of temper, which spread sunshine on all about him.

How estimable was he in the common relations of life; how exemplary as a Christian, how valuable as a citizen, how pure as a patriot, how ready, how dignified, and how brilliant on all occasions when political difficulties demanded his services and his eloquence!*

In his deportment there was nothing imposing; yet his manners were exceedingly graceful; they had the affability and dignity of true politeness. To the young and the humble he was always accessible and singularly agreeable.—From this cause the junior members of our profession were extremely fond of consulting with him; for while they were sure of benefit from his advice, they had never to apprehend that they should be borne down by the display of his superiority.

His love of social intercourse was indulged as much as his more serious engagements would permit; and always with great delight to those with whom it was maintained. But to advance the great interests of society, to promote the great cause of humanity, were the more constant objects of his regard. In his sudden departure from Salem, in 1775, and in the personal sacrifices which he so readily made at that time, we see his love of country breaking forth with an enthusiasm, which partakes of something romantick and chivalrous. Highly worthy of ad-

* Note E.

miration as this conduct was, yet it is of so rare a character, it might have led one to anticipate for him a life of adventure. But the causes which operated on him, could scarcely be combined again with the same force during a single life; and if there was in his youth any tendency to be precipitate, this was shortly corrected by his judgment, which gained strength with his years. The general tenor of his life was regulated by a just philosophy. If any thing of enthusiasm lurked within him, it operated only to give animation and energy to his conduct.

With all his numerous avocations, Dr. Warren found time for literary labour. He was not ostentatious in his publications; but his discourse, delivered before our society, on the Mercurial Practice, will long remain in high estimation among philosophical and practical physicians.

Amidst the various incidents and characteristicks of his life, which crowd upon my mind, I have not yet noticed his rare eloquence as a lecturer; nor do I know how to do so in adequate terms. To those who have been accustomed to its charms, I cannot appear to do it justice. His voice was most harmoniously sonorous, his utterance distinct and full, his language perspicuous and well chosen. But its more peculiar charms were derived from the animation of delivery, from the interest he displayed in the subject of his discourse, and from his solicitude that

every auditor should be satisfied, both by his demonstrations and by his explanations.

Could we be permitted to follow him into the sacred retreats of domestick life, and to view him in the delicate and endearing relations which he there sustained, his character would swell upon the eye in colours still more rich, still more grateful. It was there his happiness centred. In that connexion, which decides every thing in respect to domestick enjoyment, he found his greatest felicity. He was truly blessed in a large family, and the intercourse between parent and children was marked with all the tenderness of affection on his side, as it was reciprocated by the confidence and respect of sincere filial love.*

Let not the stranger imagine that the praise we bestow is given with the liberality so common in respect to those who have recently deceased. Now, alas! that his ear is deafened for ever, we may proclaim the praise of our respected and beloved friend publickly and aloud. His modesty with his other virtues, will now live only in our memories. But were not indeed the strains of commendation uttered during his life in language which could not be suspected of flattery even by the most skeptical, or the most jealous? Even now his eulogy is in every mouth, and multitudes will repeat it to their children with greater eloquence, though it cannot be with

* Note F.

greater sincerity, than that with which I have now attempted to utter it. The sighs of those who have lost a beloved friend and the physician to whom they looked almost for life itself, are ascending to heaven, in numerous attestations of his virtues. His death has occasioned a real chasm in society. Science and humanity will delight in dwelling on his name; and they will unite with affections too tender for publick exposure, in deploring his loss. But though cut off without attaining the full years of man, let us give thanks to Providence that he was spared so long;* and let us remember that though he did not economise his strength in the service of his friends, yet he lengthened his days by the full use he made of them.

It is only left us at present to pay the last respects to his sacred remains; but he has left a name not mortal like his body. That we may do justice to his fame, let us make it useful as was his life. Let us all, and particularly let his professional brethren, strive to imitate his virtues. Then may we hope, that when we leave these bodies cold and inanimate, as his lies before you, our spirits may renew with him a delightful intercourse in that world, where there is no more death, nor mourning.

* Note G.

NOTES.

THE following notes contain some facts which it was impossible to collect during the hasty preparation of the foregoing pages. They contain also some illustrations which may not be deemed superfluous.

Note A.

He had previously accompanied colonel Pickering's regiment as surgeon to Lexington at the time of the battle there, but had returned as soon as the service ended.

Note B.

In 1809, his son, John C. Warren, M. D. was associated with him in office. During the last two years the father has been anxious to resign his professorship, and has been hindered only by considerations, which regarded the welfare of the medical institution. He was particularly fearful of continuing in office till that period of life, when men cease to be aware of the propriety of retiring from responsible stations.

Note C.

It was not an eagerness for profit, which engaged Dr. Warren in so much business. The only reproach I have ever known made against him, by his patients, was, that he did not give them enough of his time, and that they did not always

feel assured that he possessed himself of their cases. They were not enough aware how much he could do in a little time. But let it be admitted that the reproach was sometimes well founded; yet it was made without fully appreciating the difficulties under which he laboured. It was not his fault that his calls were more numerous than he could fully answer. Such a situation, not perhaps a very common one, is extremely embarrassing to a humane physician. It is not realized by men in any other profession. His business must be diminished either by a selection of patients, on his part, or by what in our language we may call *a natural cure.* Shall he decide whose requests he will refuse and with whose he shall comply? Shall he attend the poor and neglect the rich? Then his family do not derive the benefits from his labours, to which they certainly are entitled. Shall he visit the rich and refuse to visit the poor? This must be done at the sacrifice of feelings the most praise-worthy. It does indeed seem correct that a physician should limit his own business, by refusing to visit more than he can attend properly; and that, in this arrangement, he should select those who will compensate him for his services, except in instances, where there are special claims on him. Such an arrangement seems proper, at least, in a community where medical aid can always be had from some source. Physicians surely have a right to proportion their charities to their ability as much as other men. But however true this is, men of feeling find it difficult to govern themselves accordingly; and the subject of this discourse, particularly, never knew how to deny a favour to those who asked it, on occasions much less calculated to interest his benevolence, than that of the sick soliciting his aid.

Note D.

The reliance which in certain cases we are authorized to place on conclusions so rapidly formed, is much insisted upon by Mr. Dugald Stewart; and I know not a greater name to

which I could refer, on a subject relating to the philosophy of the human mind. See his "Elements, &c." vol. II. chap. ii. sect. 2. p. 80. The following extracts give a view of his opinions; they are not however entirely applicable to the subject of this discourse. He was able "to state to others the grounds on which he proceeded;" at least on all important occasions.

"It has been frequently remarked, that the justest and most efficient understandings are often possessed by men who are incapable of stating to others, or even to themselves, the grounds on which they proceed in forming their decisions. In some instances, I have been disposed to ascribe this to the faults of early education; but, in other cases, I am persuaded, that it was the effect of active and imperious habits in quickening the evanescent processes of thought, so as to render them untraceable by the memory; and to give the appearance of *intuition* to what was in fact the result of a train of reasoning so rapid as to escape notice. This I conceive to be the true theory of what is generally called *common sense*, in opposition to book-learning; and it serves to account for the use which has been made of this phrase, by various writers, as synonymous with intuition.

"These seemingly instantaneous judgments have always appeared to me as entitled to a greater share of our confidence than many of our more deliberate conclusions; inasmuch as they have been *forced*, as it were, on the mind by the lessons of long experience; and are as little liable to be biassed by temper or passion, as the estimates we form of the distances of visible objects. They constitute, indeed, to those who are habitually engaged in the busy scenes of life, a sort of peculiar *faculty*, analogous, both in its origin and in its use, to the *coup d'oeil* of the military engineer, or to the quick and sure tact of the medical practitioner, in marking the diagnosticks of disease."

Note E.

Dr. Warren's constant occupation might account for his never engaging in political life. But he was restrained also in this respect by the laws relating to his professorship, which forbade him to accept any civil office. Yet he was not a silent spectator of publick events, nor did he fail to investigate the fundamental principles of government. In proof of this it is sufficient to advert to his oration on the fourth of July, the first delivered in this town on that anniversary. In respect to his political opinions he had nothing like indifference, and he always accorded with those, who, as they leave the stage, are acknowledged by all to have been the purest patriots; he sided with Washington, and Hamilton, and Ames. On many publick occasions his eloquence has been witnessed in the assemblies of our citizens.

The following extracts from his oration abovementioned, will be read with interest, and contain truths as important to be regarded now, as they were thirty years ago. Many passages might be cited also for their eloquence, and for the fervour of their patriotick sentiments.

"The object of publick virtue is to secure the liberties of the community. A security of liberty admits of every man's pursuing, without molestation, the measures most likely to increase his ease, and to place him in a state of independent affluence. Nothing is more conducive to these ends than a free and unlimited commerce, the encouragement of which is undoubtedly the duty of the commonwealth; and the feelings of humanity are, in a general sense, highly interested in the prosecution of it.

"Commercial intercourse and connexion have perhaps contributed more towards checking the effusion of blood, than all the obligations of morality and religion, in their usual state of debility, could ever have effected. The ideas of conquest and destruction, amongst the ancients, were commonly comprehended under the same term, and torrents of human blood

have been shed to gratify a spirit of revenge. In latter times the views of almost every powerful nation, with whom civilization has been the effect of trade, have been directed to the support of that political balance, upon which this intercourse depends. p. 10.

"Long may they (the United States) retain that spirit of union which has enabled them to withstand the mighty force of Britain, and never be persuaded, through the artifice of their enemies, to violate the articles of that confederation to which they owe their liberty. Should ever the constitutional authority of the legal representative body of the nation be annihilated, the bond of union will be dissolved, and we shall be reduced to the greatest hazard of misery and subjection." p. 23.

Note F.

Dr. Warren was born on the 27th of July, 1753. When about twenty-four years of age he married the daughter of his excellency John Collins, Esq. of Newport, Rhode Island, formerly governour of that state. He has left five sons and four daughters. Two of his daughters are married; one to John Gorham, M. D. Adjunct Professor of Chemistry in our University; the other to John Brown, M. D. of this town.

Note G.

Dr. Warren was, from the age of 30, occasionally affected with an uneasiness in the breast, which he sometimes thought would prove fatal at an early period of life. He was also subject to paroxysms of sick headach, occurring about once in a month, which continued till the beginning of the year 1804; at this time he had a severe spasmodick affection of the bowels, which recurred at different times during the space of three months. In the year 1811, a slight paralytick affection of the right side came on, and never completely disappeared. After

this last attack, the symptoms of uneasiness in the breast increased in the frequency of their appearance, and in their severity. During the last winter they appeared with a frequency and severity which was very alarming. These attacks seemed to be caused by colds. They generally took place at one or two o'clock in the morning, and lasted two or three hours, unless previously relieved by opium. The principal symptom which attended them was the sensation of a cord across the breast, and a consequent dread of suffocation, which produced great agitation and distress.

In February and the beginning of March, 1815, he underwent great fatigue and exposure, and subsequently became feeble and dispirited, and had frequent attacks of his complaint. On the 22d of March he was out as usual in the morning: but in the evening was attacked with febrile symptoms, and in the night had a paroxysm of dyspnœa. The febrile symptoms continuing the next day, he took an emetick, and appeared better on Friday and Saturday; and on the last of these days, having a particular anxiety to go out, he visited some patients, and passed the afternoon in business at home. In the night his complaint returned, and on the next day appeared alarming; the pulse being quick and very hard, tongue foul, with a fixed pain on the right side, laborious respiration, and an occasional cough. He had an emetick, a blister on the side, and commenced a course of calomel and opium; but notwithstanding these remedies, the nightly paroxysm was more distressing than any he had ever experienced; nor did he get relieved till after a copious bleeding and repeated doses of opium. The bleeding reduced the hardness of the pulse, and appeared to prevent the recurrence of severe paroxysms of dyspnœa; but the debility, which began to appear, prevented its repetition. In the two or three following days the most distressing and urgent symptoms gradually lessened; but the functions of all the organs appeared to be irrecoverably deranged. The pulsations of the heart became irregular, and occasionally intermittent; the circulation in the left

arm was peculiarly disordered; the stomach loathed all kind of nourishment; the intestines were affected with a diarrhœa, which could not be checked without being followed by great uneasiness in the breast. The lungs appeared to be in a constant state of oppression, and were filled with mucus, except when the cough and expectoration produced a temporary relief. The functions of the brain were not less impaired. A kind of stupor existed, except when it was interrupted by a fit of distress, and then an unnatural sensibility and irritability appeared. In the evening of April 3, a very distressing fit of pain and difficult breathing came on, and at last became so excessive, that he requested an opening might be made in the right side, probably with the idea that pus or water might be discharged. This pain was relieved by the application of hot tincture of cantharides and a moderate dose of laudanum, after which the night was passed with tolerable tranquillity. At seven in the morning of the 4th, he inquired the hour, then remained quiet, in a few minutes began to breathe more slowly, and almost imperceptibly expired, without any struggle, or groan.

On examination after death, it appeared that the aorta was greatly diseased. The affection of this vessel was of that sort which terminates in ossification. The extent of the morbid change was from the orifice of the vessel, including the valves, to as far down in the thorax as the sixth dorsal vertebra, and probably much farther. On the right side of the thorax the lungs adhered in all their upper part. This adhesion was evidently of long standing. The lower part of the lungs on both sides, but mostly on the right side, was greatly inflamed. The pleura on this part was high coloured, and was covered by a recent effusion of coagulable lymph. The lungs were heavy and very firm, not crepitating. When the inflamed parts were divided very few air bubbles issued; but from some portions there was discharged much thin purulent fluid. In nearly one third part of the whole lungs the air-cells were compressed by the effusion of coagulable lymph into the cellular membrane.

AN ACCOUNT

OF THE FUNERAL SOLEMNITIES AT THE INTERMENT OF JOHN WARREN, M. D.*

ON Saturday, April 8, 1815, at 4 o'clock, P. M. the corpse was conveyed from the mansion house of the deceased, to the Stone Chapel, where, after a dirge on the organ, prayers were offered by the Rev. J. T. KIRKLAND, D. D. President of Harvard University. An anthem was then performed by the choir of singers of Brattle street society, and a eulogy delivered by JAMES JACKSON, M. D. Professor of the Theory and Practice of Physick. A hymn closed the services at the church; a procession was then formed, and proceeded to the family vault. The corpse was preceded by

The Members of the Senior Class in Harvard University,
The Students in Medicine,
The Resident Graduates at the University,
The Graduates and Licentiates in Medicine,
The Fellows of the Massachusetts Medical Society,
The immediate Government of Harvard University, and
The Officers of the Medical Society.

The Pall was supported by

JOSIAH BARTLETT, M. D. — THOMAS WELSH, M. D.
LEM. HAYWOOD, M. D. — JOHN JEFFRIES, M. D.
REV. J. T. KIRKLAND, D. D. — His Honor WM. PHILLIPS.

And the Hearse was followed by
The Family,
The Corporation and Overseers of Harvard University,
The Members of the Academy of Arts and Sciences,
The Officers and Members of the Grand Lodge of Massachusetts,
The Members of the Humane Society,
The Reverend Clergy, and
Numerous Citizens.

* Furnished by the committee of arrangements.

ARTICLE VIII.

A

DISSERTATION

ON

THE PROXIMATE CAUSE OF FEVER.

By NATHANIEL BRADSTREET, M. D.

Read at the annual meeting, June 6, 1820.

IN selecting a subject for the present discourse, I have been more influenced by attachment to certain early opinions, than by confidence of ability to defend them. Such is the diversity of symptoms, and so varied are the conditions of the system, under which fever is acknowledged to exist, that no definition has yet been settled to which some objection might not be offered. Still less stable has been the fate of general views of pathology and therapeutics, which, in rapid succession, have been offered by learned and ingenious men; and which seem to have given splen-

dour to medicine at different periods of its history, but, nevertheless, have gone down with the influence of their authors. From the wreck of each system, however, fragments have been gathered, and preserved, as items of knowledge, or as specimens of progressive improvement.

By presenting a particular view of the immediate cause of fever, it is not meant to complain of the labours of others, nor to express disrelish of the fruits of industry served up by them; but it is hoped, by discoursing on a subject, which appears the most neglected, to add something to the common stock. The sentiments which will be offered are not deemed so new, nor are the inferences so wide of authority as to occasion much concern for their reception; indeed, it may satisfy my purpose, if others may be stimulated to investigate the subject, who shall be more able, or more fortunate. For it must be useful to limit conjecture, although we fail of full certainty; and there must be advantage in discriminating the cause and nature of a disease, although, in practice, medicine be continually applied according to observation of its remedial influence.

In my first practice, men of experience were not always at hand, to be consulted on different occasions. Solicitude was often felt, lest mischief might occur from my inexperience; of course, a strong interest to watch the first appearances of disease, that by observation of its

nature, and by the application of remedies in the incipient stage, extremities, demanding a more serious and difficult treatment, might be avoided. The advantage of diligence in these things was soon perceptible; and the opinion, that general disease, or fever, was of secondary character, gradually became confirmed; for preliminary symptoms were as constantly noticed in cases of fever, where local irritation might be very obscurely indicated, as in those instances, where a local affection was evidently the cause.

In the term *typhus* it is intended to include all those varieties of fever, occurring in cold climates and in cold seasons, which usually have been distinguished by the epithet *typhoid;* "such as have been described under the name of jail, ship, slow, nervous, or petechial fever;" on the contrary, by *continued fever*, it is meant to designate that fever which appears to be peculiar to the hot climates, and hot seasons. Other terms will be used in the common acceptation.

Very few diseases are to be found, in which pyrexial symptoms do not sometimes occur. When these are noticed to depend on inflammation existing in any particular part, and to have both origin and termination connected with the local disease, the fever is said to be symptomatic. Idiopathic fever, on the contrary, has been supposed to take place independently of any topical inflammation; to arise from an impression gene-

rally made; and from which, long after its remote cause has ceased to be applied, upon the occurrence of various exciting causes, a paroxysm, or group of symptoms, derives its origin, and is accounted the beginning of fever.

Though some definite result, proceeding from the first morbid impression, may be generally believed to take place, and to constitute the immediate cause of the paroxysm, yet the obscurity in which the fact is involved, has allowed much scope for speculation, and disagreement. It has appeared to me unfortunate, that negative, rather than positive symptoms, should be preferred in discriminating the disease; that, in the definition of fever, more importance should be attached to the circumstance of its cause not being clearly evident, than to the affection of parts principally suffering in the attack. If remote causes effect injury to the body, there must be circumstances of complaint which may indicate what that injury is; and if exciting causes are found necessary to the development of fever, the operation of these may be traced; and whatever period of time may elapse before its immediate cause shall be fully understood, the particular injuries sustained by the body from the operation of known causes are data, by which it must be demonstrated. Indeed, it would already appear within our reach, to unravel the mystery, and disclose the secret

"spring, which suddenly unfolds the febrile operations."

Among the symptoms indicating the approach of fever, perhaps none are more constantly observed than a dull headach, which may be more or less transient, or remitting; an unusual sense of weight in the limbs, and uneasy or painful sensations about the back; all of which may be referred to a diseased state of the muscular system. There are other signs also, as unnatural sensibility of the flesh, manifestd by soreness upon being handled; soreness of the eyes; catarrhal appearances, but which are attended by a more clouded aspect than belongs to a cold; occasional diminution of appetite, and nausea; a flushed, or dejected countenance; reluctance to labour; dulness of thought, &c. These do certainly give the warning, though it will happen, that sharpness of appetite, exhilaration of spirits, and activity shall, conspicuously, be tokens of approaching disease. Some of the antecedent symptoms may continue along with the fever; even in delirium, and in stupor, they may remain perceptible; but there is a peculiar condition of the stomach usually designated by the terms *oppression about the precordia, anxiety, &c.* which is first noticed at the commencement of a paroxysm, and is the last symptom, which disappears, as it terminates. It has been equally well observed, that irritating substances taken into the stomach,

as solid food, aggravate the fever during its continuance, and are very apt to cause a relapse after a well marked crisis had appeared. Thus we may conclude that there is excess of sensibility in that organ, suited to the display of fever. And according to Bichat, and other pathologists, accumulated sensibility in a part is to be considered an inflammatory state, in which there is increased determination of blood to the part, and excess of vascular action. It is a state, too, productive of many sympathetic affections in other parts of the system. The opinions of most writers concur in this, that the stomach is largely concerned in producing, and in maintaining the phenomena of fever. Physicians, in practice, have a settled habit of looking to the tongue as an index to the state of stomach; and, in judging of the nature and state of disease, their opinion is very greatly influenced by its appearances. Dissection of subjects, dying in the acute stage of continued fever, which has been said to consist of a single paroxysm, has demonstrated engorgement of the veins, and inflammatory appearances of the villous coat of the stomach. We may of course conclude, not only that a morbid state of stomach is inseparably connected with fever, but that this organ is irritated in a manner that readily produces inflammation, if, in the first instance, it cannot be said to be inflamed. Still, it may be conceived that this state of the stomach

is not the proximate cause, but an essential part of the operation of fever. If it be necessary to the existence of fever, yet it may depend on previous derangement in other parts of the system, which sometimes may, and sometimes may not be in force adapted to this particular consequence. Such previous derangement, then, may be considered the *sine qua non*, or the immediate cause of fever. This opinion is now advocated. But aware of many difficulties in the way, I proceed in the investigation with diffidence.

The effluvia proceeding from marshes, stagnant water, and from other sources, are still regarded as febrific materials, but their essence does not yet appear to be understood. The only way to comprehend the nature of fever, depending on such a cause, must then be, to search out the injury sustained by the body previous to the accession. It is important to distinguish the character of derangement produced in particular parts, and to regard the more fugitive symptoms that first appear—the cause of which probably forms a foundation for the disease.

The excess of heat and severity of cold, when sustained beyond the period to which the powers of the system are able to hold out in resistance, appear to operate as remote causes of fever; and sudden changes of temperature have undoubted influence as exciting causes. The agency of winds, or currents of air striking on the

body, generally, or partially, together with the power of moisture in the atmosphere, may simply have relation to temperature by facilitating its action.

Among people equally exposed to the action of noxious causes at the same time and place, symptomatic fever, as well as idiopathic, may be noticed to distinguish the character of disease in different individuals. Cold, moisture in the atmosphere and other reputed causes of idiopathic fever may produce signs of derangement in the system, which, after various space of time, may result in fever, or may wholly subside without it. The same uncertainty and consequence may be observed with respect to symptoms, which precede the establishment of local inflammation necessary to symptomatic fever. Consequently, by observing principles which operate in producing the cause of symptomatic fever, means may be obtained for penetrating the more secret enclosure of idiopathic fever.

In catarrhal disease, we often notice headach, flushes, chills, uneasiness throughout the body, and evening exacerbations. These symptoms are also common to fever. And, before inflammation in the pituitary membrane, there are preliminary symptoms which appear to arise from the action of cold directly; such as defect of perspiration, unusual sensibility to a current of air, or chills produced by slight diminution of temperature.

If remedies be not applied seasonably, and especially, if new exposures are heedlessly encountered, local inflammation is soon established. When it fixes upon the pituitary membrane of the nose, or even extends to the palate and throat, but without concentring to a definite point, the consequence is disease simply called a cold; but when the inflammation, first diffused upon the membrane of the nose and throat, concentres at some point about the fauces or larynx, a relative variety of cynanche is produced. In epidemic catarrh, or influenza, inflammation appears to pervade the whole pituitary membrane, as in extent it lines the bronchial vessels and cells, the throat, the nose, and sinuses connected with it; but the point of concentration is frequently transferred from one place to another. When inflammation becomes fixed in the lungs, and shows concentration there, by the pleuritic stitch, the phenomena of pulmonic fever succeed. When primarily, or consecutively, it fixes in the muscular system, the disease is rheumatism, which, by varied and changing points of concentration, unfolds, in open view, the nature of metastasis, the pain, heat, and tumefaction subsiding in one place as they occupy another. Thus general disease is maintained in a manner, somewhat departing from the character of symptomatic fever. It often happens in cold seasons, that, with some topical affections analogous to those causing

symptomatic fever, the principal irritation manifestly belongs to the abdominal viscera; and in this event it is believed invariably true, that some modification of typhus will be found to exist. It may then be stated, that the character of fever is diversified by the relation, which the part principally irritated bears to the system in general: and that it is symptomatic according to the determinate fixure of its cause; and may be considered idiopathic according to the facility of change in place, which happens to that cause.

Malignant disease, from the state of ulcer to that of fever, seems marked by destructive concentration. Fever in this state, perhaps more frequently than all other forms of disease, has constituted the character of epidemics. And though epidemic disease may be capable of assuming all forms, yet these probably depend on some common injury, which varies in ultimate consequences, according to the importance of the part, on which the weight of disease principally settles, and upon its quantity thus concentrated. When the disease appears in the form of fever, its onset is frequently sudden,—the immediate cause is either insensibly made, or it is so rapidly produced as to escape the notice of the most vigilant observer. But in the midst of the most fatal plague, there are certain milder cases to be observed. These, it is true, may either have less of the common malignity, or they may be

radically different. However, from multiplied observations of disease in periods of pestilence, it would appear that a common taint was every where perceptible. Fever has been noticed to be converted into local disease, and local disease into fever. Particular circumstances have been supposed to influence these decisions, and changes. It has been said that fever was not a disease of the open field, but frequented camps, and other places, where men were crowded together for the purpose of shelter; that it most frequently commenced the attack subsequently to rest of body after severe fatigue, desultory exertions, &c.; that where the remote cause existed in great force, disease for the most part appeared in the form of fever, but when the cause might be in diminished force, that ulcers of the legs, and leprous blotches upon the skin, were the ordinary marks of its operation; that a sudden cure of these exterior local affections was apt to be followed by fever in genuine form, &c. But fever, which cannot be called malignant, does sometimes exhibit similar changes. Disease having a determinate seat, as dysentery in common seasons, will occasionally change to fever. The difference in fevers, then, as to violence, may be sufficiently well distinguished by the usual comparitives *mitior* and *gravior*. But at the same time, it is confidently to be presumed, not only that the remote, but also the proximate

cause, and the nature of the disease itself, are more strongly marked in its higher grades.—And, except when malignant fever has proved fatal at the onset, too soon for an irritating cause to have fixed the marks of inflammation, the records of dissection will show that local mischief did appear, and that, where the symptoms had indicated the principal suffering.

With respect to ulcers of the extremities, and leprous defœdations of the skin, which appear to hold connexion with fever, it may be sufficient here, barely to remark, that inasmuch as these appearances are often found connected with faults in the digestive organs, they may also be considered vicarious of internal evil, or irritation, the operation of which, in other instances, is to produce fever ; thus, they witness to the fact, that the febrile cause is seated within the abdomen.

We will next consider an epidemic disease of comparatively mild character—the influenza, which has often been noticed in the train of pestilential diseases, and would appear sometimes capable of constituting their malignity. This disease has been witnessed very frequently in our country, and at each different season of the year. It has prevailed in certain towns and districts, when typhus, spotted fever, and malignant pulmonic disease, have visited other places, sometimes very near in its vicinity. Ty-

phoid appearances, however, have very rarely been seen blended with it, except in the cold seasons, as the winter and spring. Cold and wet weather, seem, generally, to have attended its appearance, and have been accounted a principal cause of it. But there are circumstances, some of which I shall have occasion to notice, which might lead us to believe that hot weather had first impressed upon the body a predisposition to disease. Its immediate cause may then be of complex character, a sort of hybrid nature, a combination of mischief made by heat with derangement made under the influence of injurious cold. The symptoms distinguishing the disease, have a corresponding strangeness; exacerbations occur with great irregularity as to time and character; at one hour, there will be almost incessant sneezing, with copious streams from the eyes and nose; at the next, these appearances may cease as if disease were finished; again they may return, or a new set of symptoms may succeed to them, as soreness in the lungs, accompanied with a teazing cough, &c. Again, severe pain may fix about the eyes, with considerable fulness and excitement of the part affected; sometimes the pain will fix in one eye, or just above it, in a spot as small as that of the clavus hystericus; inflammation, sometimes more firmly fixed, may occupy one or both eyes, one or both the frontal sinuses, and proceed to sup-

puration; but for the most part, the pain gradually, or at once, subsides, after having raged several hours; inflammation sometimes becomes firmly fixed in the lungs with a corresponding grade of pyrexial excitement; and when the systematic turmoil perceptibly begins to decline, something of the tertian character may be observed in the order of its stronger exacerbations, and usually continues for three or four periods; when, apparently, the disease has terminated, it may suddenly relapse upon the slightest exposure, and thus be protracted many weeks.

Colds are seldom mentioned by writers on tropical diseases, nor are they often spoken of by people who have visited the hot climates: instead of a cold, a fever appears to be the common consequence of exposure. It is true Lempriere has noticed the occurrence of colds on the banks of rivers, &c. in Jamaica. In his tables of diseases, he has even put down *catarrhal fever*, but has no where given a description of it. Indeed, I do not know that the disease which we call influenza, has ever been recognised within the tropicks. Nov. 1799, during a cold north wind off the coast of Florida, the ship Merrimack had its crew generally affected with influenza, but on going into the Havana soon afterwards, this disease disappeared as a snow ball might have wasted.

But in order to exemplify the connexion of

diseases, which probably depend upon the same remote causes, and to remark upon their difference connected with peculiarity of the proximate cause, it may not be deemed unsuitable to take a view of diseases occurring in a series, and influenced by change of seasons. For this purpose it may be allowed me to state diseases, as they were observed at Newburyport, after the remarkable heat which distinguished the summer of 1820.

Remittent fever, which began in July, continued to occur throughout October. It appeared principally limited to the south part of the town. There were a few cases of greater severity, marked by malignant symptoms, yellow skin, black vomit, &c. in September. These were confined to a small extent of ground, a ridge, having the river on one side, and a low plat on the other, to which it is said the tide formerly had access. In one of these cases, which did not prove fatal, the symptoms of the acute stage were entirely similar to those of the remittent generally; but after four or five days, there was a space of one day, in which a crisis appeared to have finished the disease; yet afterwards, a very frequent and weak pulse, deep yellowness of the skin, general uneasiness, and great debility occurred suddenly; the alvine discharges continued to exhibit a dark green appearance, and the urine was high colored, as if strongly tinged with

bile.* Several patients, at a distance from this neighbourhood, were similarly affected about the seventh day of the remittent, but without the yellowness. These were very apt to sink under the sudden oppression; and unless carefully watched, and supported by wine, cordials, warmth, &c. a very few hours would put the case beyond the means of relief.

As the cold weather became considerable, late in the autumn, the influenza commenced, and continued through the winter and spring. After the first flight of snow, last of October and first of November, it became very rife. The remittent had disappeared altogether.

About the time the influenza was first noticed, last of September, one or two cases of jaundice occurred. Afterwards in the winter, an unusual number of people were affected with this disease. The last case occurred in May. In some instances, exacerbation and remission were perceptible, but in others no febrile commotion could be distinguished; yet in all, oppression at stomach, precisely the same as is complained of in fevers of type, was a leading symptom, and was much more considerable at some particular period of the twenty-four hours, usually in the evening.

In January, February, and through the spring,

* I did not see this patient, but have full assurance of correctness as to the facts.

cases of typhus were occasionally met with. The number of these decreased with the approach of warm weather, but the intensity of disease, in those in whom it did occur, was not abated.

There were other diseases current with the typhus, as ileus, erysipelas, sore throat with rash upon the skin, croupy affections, rheumatism, &c.

Individuals who had just recovered from the influenza, being much chilled in their exposures to the cold, were suddenly taken down with fever and sore throat. With these the course of fever was rapid, distinguished by severe nervous affections, and occasional paroxysms of delirium. At the crisis, aphtha suddenly crusted over the whole mouth and throat, and erratick pains would shoot along the limbs "as if in explosions." In some instances axillary and other abscesses were formed, and seemed to terminate the fugitive pains; in others rheumatism would become fixed in the limbs, and thus distinguished the sequel.

Some relation to the autumnal remittent, by means of a local cause, or "latent mischief," which might remain in those who had escaped the remittent, and which might modify all the subsequent forms of disease, is presumed. Care was taken to ascertain whether subjects of the remittent were exempt from influenza afterwards, but observations were not made with

sufficient exactness, nor to sufficient extent, to allow me now to declare the fact. Nothing occurred which could make directly against such supposed security. No one, who had suffered by the remittent, was known to be affected with the subsequent jaundice, or the typhus of the winter.

That a local affection of the liver was necessary to the remittent, is inferred from the bilious appearances uniformly accompanying it. But between this morbid result of the operation of heat, &c. upon the system, and the evolution of fever, consecutive effects might intervene, and constitute the proximate of fever. The connexion of the liver with the abdominal viscera by means of the refluent blood from them passing by the vena portarum, makes it obvious, that any irritation produced in that organ, which might cause constriction of its capillaries, must cause a venous plethora throughout the abdomen. And it cannot be supposed that such fulness should fail to create uneasiness, and with it, increased or irritated action. The inflammatory process thus founded, may as readily become concentrated, as if it had occurred in the lungs, or any other part of the system. And provided this take place in the stomach directly, or be transferred to it from some other point, the train to the remittent may be found completed; the proximate cause is irritation, perhaps generally diffused

in the abdomen; the first act of fever, is the sensation at stomach, produced by its receiving the concentred excitement.

The yellowness of skin noticed in the few malignant cases which appeared in September, is believed to have been caused by bile regurgitated into the blood as in jaundice; because the state of excretions manifested the presence of bile in all cases in which remissions were perceptible, even in apparent quantity corresponding to the degree of remission, greatest at the crisis, &c. It is admitted that, in the malignant cases, it did not always appear till after the pause; when it did, it marked a mildness of the disease: and here, doubtless, remissions might occur, although imperceptible at the times of observation. It is remarkable that this pause, so characteristick of malignant fever, especially when produced under the influence of great heat, should seldom be followed by the ordinary febrile phenomena. But inasmuch as almost all diseases have a short run, in a ratio of their violence, this peculiarity may be derived from the varied operation of a common cause; the irritating principle being more determinately fixed, that relief, which in milder cases happens from remission, is not found, and the life of the part primarily sustaining irritation, is either exhausted, or may be so greatly impaired as to make recovery difficult. The frequent failure of life succeeding to this

pause, might lead us to think some radical difference of cause existed, were it not known that life, in this delicate situation, might be preserved by supporting the common movements of the system for a space of time too short to allow the idea of destruction, or even very great exhaustion of the powers of the stomach. When these powers are very greatly crippled, or the organization of the stomach ruined, death may necessarily succeed; and there may be no sensibility left, by which the turmoil of fever can be reproduced. When such mischief is not effected by a first attack, or paroxysm, the oppression which follows the intermission, remission, or pause, may be viewed in the light of a new attack, or paroxysm, having the same character as at first, but in an increased, and often in a fatal force. Hence it is inferred, that there is no essential difference in the predisposing, the remote, or proximate causes of fever, whether it be continued, remittent, or even intermittent, except in degree.

That "latent mischief,"* founded in the hot

* This expression has been very much used by practical writers; and by it, they probably understand a contamination, produced by animal effluvia, marsh miasmata, &c. which waits the occurrence of certain causes, as heat, cold, moisture in the atmosphere, &c. to produce fevers. But by its use here, it is intended to designate an inflammatory state of the liver, or such condition as exists, when an undue determination of blood to this organ by the hepatic artery is established.

season, contributed to produce the jaundice which appeared in the autumn, and afterwards, cannot easily be rejected. For, in the depth of winter, when this disease was most frequent, it will not be supposed that miasmata were present; it is universally admitted that frost not only suspends their evolution, but destroys them already formed. Should it be said miasmata are not necessary to jaundice; whatever might have been its origin, as to cause, the facts are to be stated, that all diseases of that period exhibited tokens of hepatic affection; that mercury was as decisively remedial in the jaundice, as it has been found to be in hepatitis, a disease peculiarly the native of hot climates and seasons, and a stranger to the cold. It is well known that people from cold countries are readily susceptible of malignant fever in the hot; and if the reverse has not been so fully ascertained, yet it has been repeatedly noticed, that those who have gone from a southern to a northern climate, have discovered uncommon liability to typhus in its worst form. A similar predisposition bred in the summer, may be developed in the winter; and the principle on which such liability or predisposition depends, may be, that local irritation had been formed, but general disease had not been induced; the cause remaining in the latent state. However, new causes, afterwards, produce derangement in a different suit of parts,

and general disease is induced, corresponding in the main to the character of parts last injured, but receiving modification from the latent mischief. It may be true that general disease diminishes the facility of the system to be roused into febrile commotion, even from the operation of new causes. It may also happen, when the operation of heat, &c. upon the body, shall have produced a tendency to constriction of internal capillaries, that the action of cold upon the surface, the lungs, &c. shall indirectly oppose that tendency; and provided the subject do not escape altogether, yet local disease may take place in the internal organ sustaining local mischief, as in case of the jaundice we have noticed.

In the winter, the influenza and typhus were so intimately connected as sometimes to make it doubtful, to which the case should be referred.

In general the influenza was preliminary to the typhus, and ultimately appeared to be converted into it. The flying pains in the limbs and inflammatory affections of the throat may be referred to its catarrhal origin. Ileus, erysipelas, rash, &c. are supposed to indicate irritation in the digestive organs, which, differently modified, might have caused typhus. These, as well as the typhus, were generally preceded by influenza, a considerable time. Many facts related by practical writers, might be adduced in support of this view of the formation of typhus;

but it is thought best to rely on the explanation of symptoms, which we have ourselves noticed, in the attempt to demonstrate the immediate cause. Such may be the surest course to avoid injustice to others. First, then,

The distinctive symptoms of the typhus in question were a lurid countenance, frequent moaning, slow bowels, and offensive discharges; the pulse in some were altogether natural, in others frequent and depressed, in others frequent and full, in many they were irregular. In some there was considerable soreness of the flesh, especially manifested upon being handled in moving them, &c.

The lurid looks, and moaning, indicate considerable suffering; but the patient, questioned if he feels pain, answers, no: he will, however, acknowledge uneasiness, and in particular, about the stomach and abdomen; he appears unwilling to converse much, though what he does say, seems sufficiently prompt and correct. The dejected, or forsaken expression of countenance, gives the idea of defect of animal power; but getting up, laying down, turning in the bed, and even walking, are sometimes performed with apparent ease. The depressed and hobbling pulse express considerable diminution and embarrassment of vital power; yet a speedy recovery sometimes proves the vital powers were not impaired. The deep moaning is apt to strike by-standers with an

impression of fatality; it is not such note as is uttered when keen pain is felt, but such as may be presumed were the brain oppressed, or the vital current in the bowels choked. When there is much soreness of the flesh, the patient, generally, will preserve the attitude and appearance of sleep; yet by signs of pain when disturbed, by answering questions, &c. he will often convince us that he was not asleep; he does not move, nor moan, because it gives him pain; he assumes the state of sleep, because the exercise of any sense augments his misery. Though delirium cannot be said to exist, yet it does not appear that the mind is fully conscious of the sufferings of the body.

Evacuations procured by purgatives in this disease, were often a dark green, but more frequently, especially when the progress of disease had somewhat advanced, they were of sooty blackness, without consistence or tenacity, and extremely offensive. These discharges being promoted daily during the continuance of fever was singularly beneficial; indeed the fever commonly terminated with a salutary change in their appearance; the relief obtained at each movement was strikingly similar to that of topical bleeding in local inflammation. I do not undertake to determine whence this black material was derived, whether from rupture of incipient veins, from exhalants terminating in the alimentary tube, in-

stead of mucus, or from the liver, being a still more vitiated secretion than the dark green bile; evidence from repeated dissection should accompany such explanation. But from many symptoms, particularly those of distress in the abdomen, sometimes tumefaction and tension which no estimate of the quantity of fecal contents, no tympanitic signs perceived, nor other cause than accumulated blood, could be supposed to have formed, it is inferred that vascular congestion was the leading principle of irritation. A congestion not so much derived from constriction of the hepatic capillaries, as from constriction of those belonging to the surface, or exterior parts of the body. A difference which, I apprehend, constantly obtains in the chain of causation, and essentially contributes to establish a distinction between fever peculiar to hot climates and seasons, and that which is peculiar to the cold.

Petechiæ, as well as other symptoms which appertain to typhus, were sometimes seen without a marked affection of the brain; but in no case without the dark, or black appearance in the fecal matter. Certain cases commenced with great coldness, darkened aspect, and in some instances with pertinacious vomiting. I have witnessed patients to have their fingers and hands somewhat swollen, with a degree of coldness which appeared to me lower than the temperature of the room. Those affected with vomiting

often expressed a strong craving for cold water, which might be no sooner swallowed than ejected; yet without abating the desire for it. In all these instances the application of heat to the skin, by the bath, would suddenly change the coldness and darkened look to burning redness. In this state, cathartic remedies, and frequently wetting the body with a sponge dipped in warm water, would accomplish a very ready cure.

Seasons distinguished for inflammatory complaints have, nevertheless, produced sporadic cases of typhus, especially, in those much exposed to the cold and wet weather; than which perhaps no cause is more sure to have effect. But dysentery in connexion with typhus is of common occurrence, and is known to change to fever in genuine form. Even when existing alone throughout, its course, period of change, and termination have been observed to correspond to the character of fever prevailing at the same time. If, then, the remote and exciting causes of these diseases, as the fact would appear, are the same; if a venous plethora in the viscera of the abdomen be first formed in both, their difference must be founded in some modification of the local irritation, or the proximate cause. Of course, the character of that necessary to dysentery being known, may serve as guide to the nature of that necessary to fever. There is no reason to doubt inflammation of the colon, or rectum, to be the

immediate cause of dysentery. Effusion, the consequence of inflammation, constitutes the discharges peculiar to dysentery, while fecal matters are retained above the seat of that inflammation. Now, irritation which depends upon a diffused congestion, must in the first instance be diffused also. But if this diffused irritation becomes concentrated, and inflammation be fully developed in the colon, the disease is dysentery. But, as some time happens, if fever appear in connexion with dysentery, the irritation of feces retained above the seat of the dysenteric cause, with such as may still belong to the congestion, may be supposed capable of concentring at the stomach; and in such case, whether the dysenteric symptoms shall wholly cease, or not, the phenomena of fever may succeed. We frequently meet with cases of fever founded in the suppression of dysentery by the use of unsuitable remedies; and there is a natural order of disease to be observed, as to the succession of forms. Thus, diarrhœa shall occupy the first stage, dysentery the second, and fever the third. The reversed order may sometimes be also distinctly traced; as fever occasionally terminates in dysentery, diarrhœa, &c. From which occurrences, it may be inferred, that evacuation from the seat of irritation may diminish, and even change the febrile cause; and, on the contrary, that defect of effu-

sion, or of evacuation, may be a requisite state of irritation causing fever.

It is said that cold repels the blood from the surface and extremities, and produces engorgement internally. When in considerable severity, whether from degree of intensity, from circumstances which increase its power, or from duration, it overcomes resistance made by the system, the action of capillaries in the skin, pituitary membrane, &c. is diminished; but, unless the processes of life be wholly suspended, those of internal organs, seated beyond the direct influence of cold, must necessarily be increased. If the calorific process be conducted by capillaries, it must be chiefly maintained by those distributed internally. The greater quantity of food usually consumed by people inured to the cold, demonstrates increased activity in the digestive and other processes maintaining life. From these and many other circumstances attending the operation of cold, it is believed its noxious influence is especially operative, in producing opposite states of excitement in the interior and in the exterior parts of the body; and from which the accustomed balances of action are interrupted; the natural movements of the whole system, if not perverted, are yet reduced to new arrangement, in which the exterior parts, sedatively affected, show increased ability to act when the suspending cause ceases; interior parts,

on the contrary, have been inordinately stimulated, and, if not otherwise diseased, have sustained diminution of power. Doubtless it may be true, that all parts of the body acquire strength by exercise, gradually increased; but sudden exertions, and greater than are ordinarily practised, diminish power, or rather, produce temporary disease. For instance, when the limbs have been violently exerted, tumefaction and soreness, or a condition of inflammation may succeed, especially perceptible after a space of rest. Here, it is not to be presumed, that solution of continuity was effected in any of the fibres of muscles so exercised; but there is sufficient evidence of debility, engorgement of blood vessels, and determination to the part affected. A similar condition may obtain in the central organs subsequently to strong impressions of cold; but perceptible inflammation may not always follow; excitement, succeeding in parts which had undergone restraint of action, may divert the determination from the interior seat of injury; nor is the tumultuous action of the arterial system, the glow on the surface, &c. which resemble the febrile exacerbation, to be accounted proof of fever actually existing; these appearances, for the most part, presently subside, and without leaving morbid consequences. In established fever, we do not merely find whole suits of parts opposed in regular grades of excessive, and defective excite-

ment, but violence concentred in individual organs; instead of an ephemera with entire disappearance of disease, or an equilibrium produced upon the first subsidence of commotion, a part remains irritated. Perhaps some defect, unperceived before the general excitement, or accident subsequently, might account for such local evil. When, however, a local irritation does exist, it appears to stand as cause to the general disease which follows. If the central organs have sustained diminution of power, or derangement, which shall not be so soon restored as the exterior excitement shall subside, irritation may be considered already founded in parts especially concerned in the production of fever. And if fever commence after proof of local disorder had existed in the previous symptoms, why should not the local disease be presumed to make the beginning, or to be the proximate cause of the fever? And if such local cause be susceptible of metastasis, as is seen in rheumatism, may it not explain those changes which appertain to fever? And also, the occurrence of crisis, and of conversion to other diseases, at every period of its course?

It will not be denied that the digestive organs are diseased at the onset of fever, and remain so during its course; nor that inflammation does sometimes occur in them connected with the fever. Common consent may also permit the statement,

that the symptoms of general disease vary according to the different parts which inflammation may occupy. Still, it may be contended, that, if irritation be concentred, and thus becomes the cause of symptomatic fever, it is not so in idiopathic fevers. The question may still be returned, does not fever exist independently of local irritation? Without undertaking to parry logical distinctions founded in the etymology of words, but endeavouring to keep in view things which the words represent, I would reply, that, for aught which can be discovered, both general and local disease, both idiopathic and symptomatic fever spring up under the influence of the same causes. And it does not seem probable, that circumstances of health in the individuals attacked, and which may constitute aptitude to one or the other form, should so much change the essence and nature of disease, that laws distinctly seen to prevail in one case, should cease to operate in the other. If then, by any chain of cause and effect, we can show where fever begins, we surely exhibit its proximate cause. And provided we do this by observing the operation of causes well known, the result should hold generally, notwithstanding unusual appearances now and then may be noticed, which cannot be explained.

In a climate like ours, cold is familiar; its effects on health, and disease, are largely experienced:

it may be presumed, of course, that, in its effects, principles essential to disease may be found.

But different parts of the system sustain contrariety of injury from the operation of cold; and it may be said the combined effect, or generality of disorder, should be considered the foundation, or complicate cause of fever which may follow. With the celebrated Fordyce, it may be contended, *that if cold produce fever, it does this at once, or makes "such symptoms of it as afterwards spread over the whole system, so as to make a complete attack.*" But in this place, we cannot forbear to notice other statements made by this author, e. g. that *the application of cold must be sudden, and after the body has been overstimulated by heat, in order to produce fever at all. In cold seasons many cases of catarrh, pneumony, and rheumatism occur for one of fever. In fever, certain parts of the body suffer more than others. Fever "is undoubtedly a very considerable irregularity;" inflammation is also an irregularity, is made by the fever itself, frequently carries off the fever, although sympathetic commotion may continue along with it. Danger "arises also from the blood being propelled from the exterior parts, in the time of the attack, to the large internal vessels: but especially to the vessels of the abdomen, and particularly those of the spleen and liver.*" To understand the meaning of these expressions and sentiments, it will be necessary to have constantly in view the *key note* of this dis-

tinguished writer. "*Fever is a disease the essence of which is not understood.*" Thus, cause and effect may very naturally be blended: a mind satisfied with distinctions predicated on appearances only, must be liable continually to mistake the cause for its effect, and the reverse.

It is believed seldom the case, that the severer forms of even symptomatic fever commence with the first impressions of cold; uncertain or fugitive symptoms usually precede the attack; and, from repetition of exposure, from metastasis of the cause, &c. it happens, for the most part, that pneumony, rheumatism, and sometimes typhus are subsequently introduced: as when pulmonic fever succeeds to catarrhal inflammation, irritation in the lungs no sooner produces systematic commotion, than appearances of inflammation in the pituitary membrane of the nose, &c. are suppressed.

Congestion in the vessels of the abdomen may take place from the operation of cold simply. And if such be the foundation of fever, the disease may be typhus in its most simple state. But visceral congestion may occur as an effect of different causes, or may be produced in different ways; from constriction of the hepatic capillaries, in consequence of an inflammatory state of the liver; local disease in other viscera may cause defective excitement, or constriction of capillaries, in distant parts; and thus, the local plethora im-

mediately depending on excess of vascular action, may be greatly increased. Do we find gastritis, enteritis, or peritonitis, unaccompanied by symptoms common to fever? It is from the acuteness of pain, chiefly, that we distinguish these diseases. The typhoid state is often observed in pulmonary consumption; and so varied are the sympathetic derangements which succeed to disease of an important organ, that it is not difficult to imagine occurrences which may naturally involve a congested state of the abdominal viscera. I say nothing of particular affection of the brain, though it must be liable to sustain primary injury; because cases of fever have not occurred in which I could feel satisfied such injury had caused the attack; and there are cases in which the head appears to suffer very inconsiderably, until near some critical period; delirium has been said to mark the change, &c. Difference of manner in which abdominal congestion is produced, may vary the character of fever growing out of it; but unless such diseased plethora be intermediately established, I apprehend the remote causes of fever, will invariably fail of ultimate effect.

Typhus is often found connected with infarction of the alimentary canal by scybala. These may irritate by acrid qualities, or by their bulk. But however this may be, it can hardly be imagined that such collections should have been formed, had the part occupied by them retained its healthy

state. Passive debility, at least, must be presumed, and of course, liability to vascular congestion.

Chronic enlargements of the spleen and liver subsequent to intermittents, and tubercles in the lungs which have been imperceptibly formed, may be sustained an indefinite length of time, unless accident, or some exciting cause, occur to make irritation.

In hypochondriacism there is evidence of debility, congestion in the digestive organs, with irritation sufficient to cause sympathetic action in great variety; its symptoms obstinately maintain the chronic character; yet, as if instinctively aware of danger, the subject is continually in dread of cold, dampness, and of other causes which might induce the acute state.

The causes of scurvy, in many respects, are similar to those of typhus. They are diseases equally observed among people crowded together, who have been meanly fed, badly clothed, and exposed to the action of cold, dampness, &c.—And to show the agency of cold in producing them, it may be sufficient to notice the fact, that warm clothing, warm food, hot beverages of tea, coffee, &c. are found the best preventives, and the most useful remedies, in avoiding and treating them, wherever they appear to arise spontaneously, i. e. without specific cause. Deficient heat is thus directly supplied, and is promptly remedial; but if, by wine, ardent spirits, &c. the enfeebled

system is urged to create it, the design may fail, or if it succeed, a still greater waste of power will be sustained. It is not denied, that living on salted meat, and privation of vegetable aliment, contribute to the formation of scurvy; but it is believed these circumstances have less importance than is commonly attached to them. If scurvy be peculiar to ships on long voyages, and sailing in cold seas; typhus is as constantly attached to a camp in the cold seasons, and also to the wretched habitations of the poor, and to ships sailing near the land, lying in harbour, &c. The changes oftemperature are greater on, or near the land, than on the ocean. It is a common remark, that colds are not contracted by exposure to bad weather at sea, as is the case on shore;—perhaps the difference of disease under these circumstances, may rest on the principle, that the same states or vicissitudes of the weather which produce colds, are causes of fever.

Congestion in the viscera of the abdomen is believed necessary to fever; because symptoms of the attack indicate such a state; because evacuations which diminish these appearances, subdue the fever also; and because heat and cold, having a general influence as predisposing causes, appear naturally to produce such diseased fulness.

Irritation supervening upon the visceral conjestion, and causing morbid sensibility in the

stomach, is believed the proximate cause of fefer ; because oppression about the precordia appears to be the first symptom of the presence of fever, and disappears only with its cessation.

The character of irritation causing fever is believed inflammatory; because malignant fever manifests the speedy development of inflammation ; because the same remote influences, which produce idiopathic fever in certain instances, do in others unequivocally cause topical inflammation with symptomatic fever ; because local diseases undergo commixture and communication with fever, and because local inflammation and fefer have many corresponding traits of character. Is it the property of fever to exacerbate ? The same may be seen in inflammation. Does fever terminate by crisis ? Inflammation disappears by resolution. Are the causes of fever held in check by the mind's being intensely engaged in the execution of interesting affairs ? In the same manner, a small wound may not be perceived, nor will it inflame unless sensation be first excited.— And in all respects, idiopathic and symptomatic fever exhibit appearances of such strong similitude, that the cause of one known, is presumptive evidence of the nature of that which may be concealed.

The stomach is allowed to hold a distinguished share in the turmoil of fever; and being the common centre of organic sympathies, irritation, probably, must be felt in this organ before fever

can take place. But the requisite degree of irritation must be presumed to fall within certain limits; for there may be supposed a grade too low to have effect; and also, a grade too high to admit those sympathetic changes which distinguishes fever from many other diseases.*

* The two following cases in which death occurred from effusion of the contents of the small intestines into the cavity of the abdomen, may show that great irritation has a sedative influence upon the system at large, and which may be so steadily maintained as to preclude the train of fever.

January, 1808, ——— a lad a dozen years old, first had the symptoms of common ileus; on the third day, plentiful evacuations from the bowels were procured; he appeared entirely relieved; but on the fourth day, he complained, suddenly, of severe pains throughout the whole abdomen, and had no evacuations. The countenance was shrunk and ghastly; the pulse feeble; the natural warmth at the surface appeared diminished; there was no delirium; he died at night, without struggle, and his intellect unclouded to the last. By examination, a small hole, perfectly round and smooth, without appearance of inflammation connected with it, was found in the lower part of the ileum; much of the liquid contents of the intestine had been poured into the cavity of the abdomen; a light blush of inflammation occupied the viscera.

July, 1811, ——— a truckman, after supper, received a kick from his horse in the left hypochondrium. There was no marks of injury externally; complaints, appearances, &c. similar to those in the boy, as above stated; excepting a remarkable fulness of the veins was noticed in his hands and arms; small bleeding appeared to produce faintness, with subsidence of the veins, but their fulness returned as the faintness went off; he died the next day at noon. On opening the abdomen, the liquid contents of the intestines were immediately seen; a small jagged aperture in the upper part of the

And because fever is a disease subject to continual changes, the appearances in dissection cannot be relied on as furnishing any sure criterion of its incipient cause; many ultimate consequences are wholly distinct from the local violences, which exist at the commencement; and local affection, which might have constituted its origin, may have disappeared under critical determinations to other parts; even these may have disappeared, and yet death may take place. There is a sentiment in point made use of in the writings of Dr. Rush. "——Death in this, *as well as in many other cases in which medicine had done its duty*, appeared to be the inevitable consequence of the total abstraction of the energy of the mind in restoring the natural motions of life." Certainly there are cases in which death appears to take place from exhaustion, or the sudden cessation of excitement, immediately subsequent to a crisis. And in this event, if the local cause had made perceptible impressions, these, it must be presumed, would disappear with the disease.

jejunum, was the only mark of primary injury found internally. The peritonical envelope was extensively, though but slightly inflamed.

Here, it does not appear that death succeeded to the effects of inflammation; but rather, that the functions of organs irritated might have been suspended, and that the movements of life, generally, were gradually diminishing to the time of their final failure. The sudden and great oppression at the commencement of fever, sometimes, appears to terminate life still more speedily.

Difficulty in finding the marks of a local cause, cannot be proof, therefore, that such had not existed.

Cases of fever are occasionally met with, in which symptoms of termination appear at some usual period of crisis; yet after some short space of time, coldness of the surface and extremities, and other signs of beginning fever, set in suddenly, and extinguish life. In this state, as well as in the severe cold stage, which sometimes attends the commencement of fever, vesicatories, and heat applied to the skin, wine and other cordials taken into the stomach, &c. may divert the tide of fatal oppression; and provided *the natural motions of life* may be maintained but for a single day, health may be readily re-established; but otherwise, should the patient escape immediate death, fever in the adynamic state is apt to proceed with great uncertainty of duration and event. Such changes and consequences frequently occur in hot climates. And although conclusive proof of the proximate cause cannot be derived from ultimate occurrences, yet the fact deserves to be mentioned, and from the authority of almost all writers upon diseases of the tropics, *that the great majority of men worn down by fevers, suffer principally, from chronic disease of some of the viscera contained within the abdomen.*

In regard to the question, whether there be specific difference in the nature of fevers? it may

be said, that were it safe to admit the essential nature of fever to be the same in all climates and seasons, because many of its phenomena, and most of the means of treatment are similar; yet, a distinction might be contended for, on the ground of difference in the manner of their production. By heat a condition of the body is established, the reverse of what is effected by cold; the exterior parts are directly stimulated, while a sedative influence is maintained internally; the appetite is diminished; digestion is difficultly performed; the peristaltic motion of the intestines, the secretions of bile, and of urine, suffer abatement; increased energy of the arterial system is directed to the surface, until disease produce changes in this common order of things. Besides differences already noticed, it may not be amiss to add the remarks of Dr. Fordyce in regard to remittent and continued fever differing in the time of attack; the remittent coming on in the morning, but continued fever in the evening.—These conditions of fever I understand to be correctly designated by the terms *fevers of type*, and *typhus*—a distinction which is believed to hold good with respect to fevers of the opposite climates; the fevers of hot climates commence for the most part in the day time, and are referrable to fevers of type; on the contrary, typhus, like catarrhal disease with which it is often connected, is bred in the cold, and commences at night.

But if the effects of fire and frost are discriminated sometimes with difficulty, the lesions made by these opposite powers, must in the beginning, if no where else, require an appropriate treatment. The means of guarding against the effects of excessive heat or cold not only are invariably included in the rules of prophylaxis, but through the whole course of treatment, regard is had to the management of these agents. If cold, indeed, be a remedy in fevers that prevail in seasons of frost, its powers are not to be considered congenial to the body, generally, but suited to the government of particular symptoms, the occurrence of which is conditional. And, if heat and cold are to be considered predisposing causes, it must be difficult to preserve a definite conception of them, as positives, under the general idea of plus and minus of heat. The common notions of animal effluvia and marsh miasmata constituting fevers of peculiar, and different character, are yet retained; and although recent observations may show the influence of febrific miasma to be less extensive than formerly was the received opinion; yet the occurrence of fever in people, who, for a short time only, have suffered their contact in sickly places, has preserved a conspicuous rank to these mysterious causes. Should it eventually be proved, however, that the typhus of cold countries, and the malignant fevers of the hot, are extinguished by a mutual change of

place, the distinction of species will be the more important. Forms of fever are here noticed as they appear in opposite climates; because in places where abrupt changes in the weather make it summer or winter for most of the year, just as the wind blows, the causes produced at one period may be extinguished by the properties of that which succeeds; or, the lesion of one period remaining may be blended with that of the subsequent, in a manner to constitute great diversity of hybrid cause.

That the malignant diseases of our hot seasons are arrested by frost, and that even other complaints, common to the summer and autumn, disappear with the approach of winter, probably will be matter of general consent; but, that typhus, a disease of winter, is equally limited to seasons of cold, may be contested. However, if the disorders of summer are constantly removed by the winter, it must follow in tolerable certainty, that disease peculiar to the winter did not exist in the summer, or had been subdued by it. Within the last thirty years, the observations of medical men, best placed to notice the influence of climate in changing the nature of fever, have gone far to support the fact. Physicians of fleets and transports, sailing from cold to hot climates, have declared the diminution of typhus as they changed the latitude, and its disappearance with the change of climate. Indeed, the sentiment

appears to have prevailed, that ships with typhus might proceed to warm climates with little danger of its continuance or fatality, provided the passage might be short.

The most common form of fever within the tropics is undoubtedly remittent. Intermittents, cholera, and continued fever are varieties depending on circumstances of predisposition, of exposure, and of accidents to the health.

Cholera and continued fever occur together; they belong to the very hottest weather, and alike are most apt to attack strangers, or people recently from colder countries; severe affection of the gastric, and hepatic system, is remarkable in both, and it is often noticed that continued fever may terminate in cholera. The difference in these diseases would appear to depend upon the abundant evacuations, which distinguish cholera, and their suppression in fever, rather than dissimilarity of cause producing them. A difference, however, in the space of time they are forming, may influence the decision. Cholera being more rapidly developed, the morbid associations in the system are less extensively confirmed than in fever, and the primary determination is more generally conclusive.

It is of frequent occurrence in people, who enjoy good health, that, having sustained considerable fatigue, and being excessively heated, they at once give over exercise, commit them-

selves to the shade, or the cooling breeze for refreshment; and at the same time indulge too freely in stimulating drinks, and in eating. In the evening of the same day, a troublesome fulness is felt in the digestive organs; restlessness is perceptibly augmented, and during the night, or as it most frequently happens, the next morning, terminates in cholera.

Continued fever does not take place so rapidly. The opinion that it is often brought on suddenly, like stunning by a blow, must have grown out of the habit of considering the onset of fever, the beginning of indisposition. It is not very difficult to perceive its approach; one day, sometimes several days exhibit symptoms of preliminary disorder, and during this period it may often be prevented. But most writers upon tropical fevers contend that there is a continued fever distinct from the remittent. The remittent is allowed to have the appearance of the continued fever at its commencement, but it is said to be distinguishable by the remitting or intermitting manner of its approach, and by the distinct character it subsequently assumes. Whereas the continued fever is said to begin at once, without notice, and to consist of a single paroxysm, which holds steadily from twelve to thirty six, or even forty-eight hours, and then terminates abruptly, the patient immediately sinking, or directly recovering; and although a

deceptive pause not unfrequently precedes the fatal symptoms, yet nothing of fever is seen in these symptoms. We have already remarked upon this peculiarity, and have nothing, in particular, to add here. But it is expressly stated that the effect of climate is to produce continued fever in strangers, at the sickly seasons, while long residents and natives sicken with remittents, &c. Now, notwithstanding the greater vigour of health in strangers, and their known liability to malignant disease, it is believed, that the length of time, in which the morbid cause has had influence, is especially concerned in determining the form. The seasoning fever, as it is called, is said to be continued; but when this takes place after a considerable period of residence, it is usually remittent. It often befals sailors, who visit commercial places within the tropics, when they fall sick in the harbour, or on shore, that the disease will be continued fever; but when attacked soon after sailing from the place, the disease for the most part is continued fever at first; subsequently, however, it changes, and very frequently assumes the intermitting type, especially as they reach the higher latitudes.—Probably we should not greatly err, were we to consider an intermittent the most chronic, and the continued fever the most acute state of the remittent.

There are particular symptoms and circumstances, which distinguish the fevers of hot climates. The lungs are seldom affected by inflammation, and the muscles rarely suffer by rheumatism; but the hepatic system constantly sustains derangement, in which alternate excess and defect of action are perceptible. Irritation accompanying the fever, or as we say, causing it, concentres in the stomach, and rapidly proceeds to inflammation. The degree of danger in continued fever, has been estimated by the effect of a certain blow inflicted upon the epigastrium. When the sensibility of this organ was such, as to exhibit signs of great suffering upon receiving a blow which ordinarily would not hurt, a fatal event was usually observed to follow; but when in this way, sanity of the stomach was ascertained, the violence of other symptoms was not found wholly to preclude hopes of recovery.

Abdominal congestion is frequently the effect of obstruction made in the hepatic capillaries.—But whether this be a primary effect of miasmata, or that it depend on some relative influence of other organs, must, like many phenomena in pathology, rest on opinion.

Fever appears to consist in unequal and unnatural action of the system; one part labouring with vitiated excess, and another with defect of the natural energies. Excessive and deficient action, excitement, and torpor, are terms used to

designate this irregularity. Each state undoubtedly represents an action of life; and either of them being produced in one part of the system, may be supposed capable of inducing its opposite in some other place. On this ground, spasm of the extreme vessels, or the negative influence, might still be vindicated as the proximate cause of fever. But from many circumstances of analogous operation, it would appear that irritation, or the positive state, occasions the capillary constriction seen in horrour. A prick of the finger by a needle produces a chilling thrill that resembles such constriction. Many moral causes have a similar effect; and though we might shrink from the task of explaining how these produce a primary local affection, yet we may catch some idea of such a process by considering the horrour felt at the deed of an assassin; we are conscious of our own brittleness; we imagine, we sympathetically feel the wound gashed by the unhallowed poignard.

But to come nearer to the subject in view, will it be contended, that sympathetic fever, arising from local injury, precedes the local inflammation? that pleurisy precedes the local affection in the chest? If, as in the laws of the electric and magnetic influences, the principles of animal life form the negative simultaneously with the positive, still we may be allowed to account that to be cause, which appears principal. In the laws of matter, attraction seems connected with repul-

sion; yet attraction is accounted the ruling principle. In the animal system, excess and defect of actions constituting the phenomena of life, may necessarily be concomitant; yet excess appears the leading influence.

In attempting to show the immediate cause of fever to be a definite result of previous morbid impressions, which, by deranging the salutary movements of the body, and disturbing the established harmony of its parts, cause a local mischief, we do not deny that fever, when produced, is a general disease in which illness pervades the whole. It is believed that different properties in the remote and exciting causes, modify the local irritation on which fever essentially depends; and that other circumstances continually diversify its appearances, and its course. To prove a radical difference in the nature of fevers, predisposing causes of opposite character have been kept in view. And on a subject of such wonderful variety as is that which embraces the phenomena of fever, it was thought the remarks of any observer might be of use. If heat and cold, prevailing in degrees of severity, stand prominently among the predisposing causes, the changes of temperature are not less conspicuous among exciting causes. So constantly do these come into operation, that it must be uncertain if idiopathic fever can occur without them. And it is not certain that opposite predisposing causes ever so blend

their effects as to constitute any simple form of disease. In seasons partaking of extremes, a strange mixture of lesions may continue to checker the field of malignity, and the protean guise of epidemics may long remain incapable of full description.

TREATMENT.

Since fever consists in irregularity of action, whether it be *sui generis*, corresponding to a remote cause of poisonous quality, or, that it be an inflammatory state of certain parts in consequence of excess of the natural action, its treatment obviously demands such means as may restore the natural equability. But, before the occurrence of symptoms which declare the actual presence of fever, there are signs of disorder which may, or may not be followed by fever itself. Not allowing such disorder to be an essential part of fever, it is considered to be a state of disturbance produced directly by the agency of remote causes; it precedes and accompanies the formation of local derangement, which subsequently excites the febrile phenomena, and of course, makes the fever. In this state, whatever prevents the local derangement, avoids the fever. And for this purpose, it will often be sufficient to avoid exposure to the hurtful causes; to preserve rest of body; to counteract the diseased disposition by mild eccoprotics, ptisans, &c.

But there is a subsequent state of system in which fever is acknowledged to be present, the morbid associations, however, are not yet firmly established. In this state, or *forming stage*, strong impressions, or shocks, are found decisive; an efficient blow, thus placed, frequently removes the whole disease; causes and their consequences alike disappear. These impressions are made by emetics, by cathartics, by cold affusion, and especially by blood letting when the vital organs are in great excitement. They may also abate the violence of the disease when too strongly confirmed to be controlled in its progress. Other remedies, with equal promptitude, may sometimes arrest the disease; and otherwise may moderate its extremes. Such are many articles of diffusible property, as wine, opium, &c.; tonics, as the bark, &c. Indeed, it does not always appear essential to success, what means are employed; it may be sufficient that a shock be produced, which may suspend the diseased associations; or in other words, which may dissipate the inordinate and morbid excitement in particular parts of the system. Thus it is, that equability being established, or local irritation removed, the phenomena of fever cease.

There is yet another mode of counteracting fever, and which sometimes entirely removes it. This is executed by making local irritation, from the use of vesicatories, giving mercury to produce

ptyalism, &c. These measures appear to countervail the disease, by concentring irritation where its reflex action may not readily involve a fever; and under circumstances in which its power to affect the system sympathetically, is greatly diminished in consequence of discharge from the local disease that is substituted; many febrifuge drugs, the operation of which is seen only in the abatement of symptoms, or the subsidence of disease, may owe this effect principally to the evacuation they occassion from exhalants terminating in the stomach and intestinal tube, to the constricted mouths of which they are directly applied.

But although it be conceded that the knowledge of remedies is derived from observation of events alone, yet the known inconstancy of disease requires a knowledge of the particular state of the system, and of the immediate cause of its derangement. And it is believed few physicians fail to make some effort to distinguish what such cause may be, as well as to regard the more conspicuous phenomena. Ask those who take a group of appearances for their guide, to what point they find their thoughts directed when they deliberate about the means of cure? They may reply, that the cause they seek, may not be the proximate of fever, but a consequence, or concomitant of the disease, to prevent or to cure which, insures safety until a crisis, naturally oc-

curring, may terminate the fever. Ask, then, how it happens that aspersing the body with cold water can cut short the course of fever? Still it may be answered, that the immediate cause, as well as the remote, may cease with its first impression; and, it is by removing subsequent derangement that the patient recovers. But, unless efficient means are used to arrest its progress, it seems a determinate property of fever to continue gradually increasing for a certain time, and then to decline, or terminate at once, from the intervention of changes which naturally belong to the cause which supports it.

Should the present observations upon the proximate cause of fever, as has been the fate of all investigations of the subject hitherto, fail to designate that cause, it is yet hoped, that certain remarks have been offered, which may invite others to the task. The subject seems gradually to have fallen into neglect, probably owing to disappointment in expositions of high authority, which have failed to support the credit with which they had been too confidently received at first. Its importance, nevertheless, in relation to practice, is not diminished. However, I will not now be further tedious by enlarging in practical remarks of a general character, but will conclude by making mention of the *lobelia inflata*, used as a remedy, in cases of fever, and in febrile disorders.

I have commonly used the saturated tincture drawn with fourth proof spirit.

August, 1819. Capt. ——— returned from sea, sick of fever, which continued gradually increasing until delirium became continual; the general assemblage of symptoms was alarming, but the brain in particular appeared to be the seat of greatest danger. Reflecting upon the diffusible properties of the lobelia, I determined to make trial of it, and gave twenty drops of the tincture, directing the same dose to be repeated every second hour. Next day, the symptoms were of milder expression, though not greatly altered. It appeared that the tincture had been regularly administered, and without producing nausea. The dose was then directed to be twenty-five drops, repeated as before. Afterwards, he very gradually mended by a regular abatement of all the symptoms, and recovered without crisis. As his delirium went off, he began to complain of the lobelia, even in a diminished quantity, when it was discontinued. Other cases were subsequently treated in a similar manner, and with the same apparent success. It should, however, be understood, that the usual remedies have never been omitted, to give trial to the lobelia alone.

March 8, 1821. Mrs. ———, aged 80, had been a few days ill of a supposed cold. On this day the symptoms of typhus were distinctly marked;

resisting treatment, the disease increased till the patient was wholly confined to the bed. The tongue had become black, dry, and chapped; there was frequent sighing, and moaning, but without delirium, or pain (except sometimes a little griping, manifestly caused by cathartic medicine, which was occasionally used ;) the pulse were extremely irregular ; there would be one large beat followed by a considerable pause, and then two, three, or four small, rapid, but yet unequal beats; gave twenty drops of the lobelia; in ten minutes the pulse were reduced to comparative regularity, being rather slow and large, varying at different hours from forty to seventy beats in the minute; the dose was ordinarily to be repeated every second hour, but in case of nausea, to be discontinued. This appearing sometimes to be produced, the lobelia from time to time was omitted; when discontinued for a space of twelve to twenty-four hours, the pulse would be found irregular as at first; the lobelia again resorted to would show the same ready influence in controlling the arterial derangement. At the end of three weeks, the dry and black coating of the tongue and mouth suddenly cast off, and was succeeded by a thick crust of aphthæ; in a week longer, this had disappeared, and the patient gradually, though slowly, recovered her usual state of health. Wine had been occasionally given, but without benefit; it appeared to be

converted to a strong acid on the stomach; a table spoonful of brandy with water was substituted, but was soon found too strong; given but once in the day, it would cause deep redness in the cheeks, laboured respiration, &c.

There is a condition of fever in which purple spots, or petechiæ, some of which will be raised into small bumps, may be seen scattered over the body. Where the cuticle is fretted off from any of these, as frequently happens to those within the lips, and on the gums, blood is continually oozing out of them. The appearances of blood in the stools make it probable that the alimentary canal may also be affected in a similar manner. The pulse will be frequent and feeble, although other symptoms of febrile commotion shall be very inconsiderable. The lobelia was made use of in two such cases. The first, a teething child,* whose pallid looks indicated dangerous loss of blood when the lobelia was recommended. The second, a lad of a dozen years; ten drops were taken every second hour for two

* I saw this patient but once, in a consultation visit. The attending physician afterwards informed me that the lobelia was given two or three times, in the dose of three drops; that the oozing away of blood was immediately stayed, and did not subsequently recur; the child did not appear to have been nauseated, but after a few days it failed, probably in consequence of severe loss of blood sustained before the lobelia was administered.

or three days, except that it was not allowed to wake him from quiet sleep. The hæmorrhage was immediately suspended on taking the lobelia; there was not much sickness at stomach, yet the disgustful taste, and unwelcome impression, made great unwillingness in the patient to continue it longer. Accordingly it was omitted, but the hæmorrhage returning, it was again used, and with the same effect. The cinchona and wine were a while employed together, but at length the cinchona being refused, wine was allowed to be given alone, and as freely as the patient might comfortably bear it. Some days he had fifteen glasses of sherry without inconvenience; he recovered in three weeks.

In several cases of typhus attended with profuse hæmorrhage from the bowels, the lobelia has appeared immediately to control this dangerous symptom.

Cholera infantum is a disease with teething children in the hot seasons, often severe, and of peculiar obstinacy. In regard to some of its principal causes, and in many of its appearances, it would seem to have relation to remittent fever in adults. The irritation of protruding teeth renders the subject susceptible of relapses from the influence of changes in temperature that are sustained with impunity by others. It seldom happens that a cure is completely effected till towards the setting in of winter. In many in-

stances, when exhaustion had become alarming, and the pertinacity of the disease had resisted other means, I have given the lobelia, in the dose of two or three drops, with decided benefit; provided it does not cause puking, it may be repeated a few times after intervals of two hours. Its salutary influence may be seen in the cessation, or considerable diminution of the vomiting, and watery dejections; in the quiet sleep; the evident increase of fulness of the features, and a more plump and better appearance generally; the diminution of frequency in the pulse, and the warmth of the flesh being more equal and natural. It is believed relapses have occurred less frequently, when the lobelia has been used, than when apparent recovery has been had without it. When it has produced immediate puking, I have seldom given a second dose on the same day; but according to its apparent influence in abating the symptoms of the disease, have afterwards repeated it. It may be remarked here, that, as the fact appears in other diseases where remedies cure by impression, or shock, it will be more decisive early in the disease, than late, when morbid associations are more strongly confirmed; but perhaps with this difference, that it should not be applied till the symptoms of exhaustion shall be pretty strongly marked.

There are cases in which the lobelia appears to operate as a charm; its effect is instant, and

the disease may speedily and entirely cease. But there is a definite dose, thrilling to the fingers' ends, requisite to its remedial impression. In too small a quantity, it fails to counteract the disease; in excess, it overwhelms the system; instead of a shock, after which the powers of life presently regain their natural operation, the stamp of fate may be seen imprinted on the victim.

The lobelia has been much used by empirics, and in many instances, with murderous effect. In some cases of chronic diseases, which had worn out the influence of common remedies, this article, even daringly exhibited, has been productive of singular benefit. There are places where its remedial qualities have given it dangerous popularity. Some account of its use, therefore, showing its power in minute quantity, may not be wholly uninteresting. A remedy possessing such very deleterious properties, cannot be inconsiderately applied, but by hazarding all that is duty, or that may be safety, to the patient.

THE END.

ARTICLE IX.

A COMPARATIVE VIEW OF THE SENSORIAL AND NERVOUS SYSTEMS IN MAN AND ANIMALS.

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At dimissâ animâ corpus caret undique sensu.

LUCRETIUS. *De Rerum Natura.*

Read at the annual meeting, June 6, 1820.

ALLOW me, gentlemen, to congratulate you on the return of this anniversary. The assemblage of so great a number of medical practitioners from different parts of our commonwealth, and the attendance of such distinguished friends of the profession* show that the concerns of science and our duty to the community are not likely to be neglected. Your society was not instituted for private advantage, nor even as a mere litera-

* Appendix A.

ry institution. The principle it has adopted, is intended to operate in securing to the public a succession of well instructed physicians, and affording a distinct evidence of their qualifications. Such is the nature of medical practice, that the community must remain in ignorance of the merits of a physician, until he has exercised his art long enough to have been extensively mischievous, if not properly educated.

It must be highly satisfactory to you, Gentlemen, to observe, that since the formation of your society, the profession has assumed a new character in this part of the country. Empiricism is scarcely heard of in some districts; in all is rapidly diminishing; but its total disappearance is not to be expected. To frown on irregularities; to connect honourable and judicious physicians in a common bond; to make them known as such to each other and to the public is what your association has proposed to perform, and what it is successfully executing.

You have also the gratification of seeing these improvements extend their influence to other and distant places. The regulations of this corporation have served as the basis for medical institutions both near and remote; and a great national work is now auspiciously forming, whose foundations were laid by your Medical Society.

Since the last anniversary, a number of those who have been among the most active in con-

tributing to the improvement of the profession and the prosperity of this society, have been called to rest from their labours. The characters of such men should not be buried in the tomb which covers their mortal part; and as no place seems so proper, as the publications of the society, for preserving the names of its active and distinguished members, I propose to add to this discourse a brief memorial of the lives of our departed associates. (*See Appendix B.*)

THE subject to which I invite the attention of the society, is a comparative view of the SENSORIAL and NERVOUS SYSTEMS in man and animals. By the Sensorial system, I mean the brain, and nerves of sense connected with it, or what are commonly called nerves of the external senses. This subject may perhaps be thought too extensive for an occasion like the present.—It would indeed be impracticable to give a minute account of these organs in the time allotted; but it will not be difficult to make a general comparison of their form and distribution in different classes of animals; and as these parts are among the most characteristic of the animal kingdom, and best fitted to distinguish it from the rest of the organized creation, such a sketch will not, I hope, be uninteresting, nor unproductive of results.

The subject is rendered inviting at the present time by the works of CUVIER, LAMARCK, GALL, LAWRENCE, PHILLIP, and others; and will call our attention to a branch of science which, notwithstanding the labours of many learned and industrious men, still presents a field ready to yield abundant fruits to the hand that shall cultivate it.

As our intention is to make a comparison between different *classes* of animals, it is necessary to determine what classification is to govern our inquiries; for you are aware that the arrangement of animals has varied with different states of knowledge and different opinions of naturalists.

LINNEUS arranged the animal kingdom in six classes, *Mammalia*, *Birds*, *Amphibia*, *Fishes*, *Insects*, and *Worms*. After his time, further observations induced the learned to divide his class of insects into *crustaceous animals* and *insects proper;* and also to divide the class of worms, into *molluscous animals*, *zoophytes*, and *worms*, commonly so called; thus making five of the two last classes of LINNEUS.

The distinguished naturalist LAMARCK,* has proposed to make three primary divisions of animals, on the ground of difference of the structure and functions of the sensorial and nervous systems. The first, he calls APATHIC ANIMALS, which do not feel, and do not move, but by ex-

Histoire Naturelle des Animaux sans Vertèbres. Tom. 1.

cited *irritability.* Of these, he makes four classes, 1. Infusoria; 2. Polypi; 3. Radiarii; 4. Worms, (*intestinal.*) Second division, SENSITIVE ANIMALS which feel, but obtain their sensations from *perceptions* only. These are 1. Insects; 2. Arachnides; 3. Crustacea; 4. Annelides, (*red-blooded worms*) 5. Cirrhipedes; 6. Mollusca. Third, INTELLIGENT ANIMALS, which feel, acquire, and preserve ideas, and are intelligent, in different degrees. These are, 1. Fishes; 2. Reptiles; 3. Birds; 4. Mammalia.

In the last systematic work of the celebrated CUVIER* a different arrangement is proposed. This author, who in the greatness of his acquisitions, and in the enlargement of his views of nature, is excelled by no one, is of opinion, that there are *four principal forms*, or four general plans, according to which all animals seem to have been modelled. In the first of these forms, which is that of man and the animals most like him, the brain and the principal trunk of the nervous system, are enclosed in a bony case, which consists of the cranium and vertebræ. At the sides of this bony column are fixed the ribs, and the bones of the limbs, which form the frame-work of the body. The muscles generally cover the bones they move, and the viscera are contained in the head and trunk. These he calls VERTEBRAL

* *Règne animal, Tom* 1.

ANIMALS—*animalia vertebrata.*—In the second form, there is no skeleton. The muscles are attached to the skin, which forms a soft covering, contractile in different directions. In this, stony substances are deposited in many species, called cockles. The nervous system is contained with the viscera, in this general covering. These are called MOLLUSCOUS ANIMALS—*animalia mollusca.*—The third form is that observed in insects, worms, etc. They are peculiar for having a nervous system, consisting of a cord or cords running along the belly, swelled from space to space into knots or ganglia. Their trunk is divided by transverse folds into a certain number of rings, the coverings of which are sometimes hard, sometimes soft, and the muscles are attached to the internal part. The trunk sometimes has articulated limbs, fixed to its sides, but is often destitute of them. These are called ARTICULATED ANIMALS—*animalia articulata.* The fourth form comprehends the animals known under the name of zoophytes, and which may be called RADIATED ANIMALS—*animalia radiata.*—In the others, the organs of motion and the senses are placed symmetrically on each side of an axis. In these they are placed circularly in a radiated manner around a centre. Their organization is very simple, and in the last families there is nothing apparent but a homogeneous pulp, which is sensible and capable of motion.

Three of these divisions, the Vertebral, Molluscous, and Radiated, appear to be conformable to nature; but that of the Articulated is in some respects objectionable. The *annelides*, or red blooded worms, are placed with insects, from which they differ not only in form and in wanting articulated limbs, but also in their organization, as we shall hereafter see. We are unwilling, moreover, to bring together a second time the crustaceous animals and insects which had been separated after the time of LINNEUS. The difference in the habits of these animals is obvious, although there is a resemblance in form; but the strongest ground of distinction is in their internal structure; that of the former being more complicated than the latter.

The arrangement most convenient for our purpose, seems to be that of LINNEUS, improved by CUVIER and others. This has also the advantage of being more generally known, from having been adopted in many popular works.* According to this plan, animals are separated into two grand divisions, *Vertebral* and *Invertebral.* The vertebral animals are first, MAMMALIA; second, *Aves*, BIRDS; third, *Repentes*, REPTILES; fourth, *Pisces*, FISHES. These classes are generally known and distinguished from each other. The invertebral animals are first, MOLLUSCA, so called from the

* CUVIER *Anat. Comp.*—REES' and BREWSTER'S CYCLOPÆDIAS, etc.

soft consistence of their bodies; although they have frequently a shell, or a firm mantle. Second, CRUSTACEA, covered with a thin calcareous crust. Third, INSECTA. Fourth, VERMES. The red-blooded worms are the only invertebral animals with red blood. Their structure is more complicated than that of worms generated in animals, or *epizoary* worms. The latter are therefore not included in the class worms, but in that of zoophytes. Fifth, ZOOPHYTES, so called from forming an intermediary structure to animals and plants. They differ however essentially from the latter, and approach the former, in generally having the power of locomotion.

- ANIMALS.
  - VERTEBRAL.
    - Double heart and warm blood.
      - Viviparous — MAMMALIA. I.
      - Oviparous — BIRDS. II.
    - Single heart and cold blood.
      - With lungs — REPTILES. III.
      - With gills — FISHES. IV.
  - INVERTEBRAL.
    - With vessels and nerves.
      - Simple vessels — MOLLUSCA. V.
      - Knotted vessels
        - With articulations — CRUSTACEA. VI.
        - No articulations — WORMS. VII.
    - Without vessels.
      - With articulations — INSECTS. VIII.
      - No articulations — ZOOPHYTES. IX.

The vertebral animals possess an internal bony frame or skeleton, the most constant and essential part of which is the vertebral column, or spine, connecting the inferior with the superior parts of the body. They have been divided into *warm-blooded* and *cold-blooded*. The mammalia and birds are warm-blooded, for they each enjoy a peculiar temperature; while the reptiles and fishes have the temperature of the medium in which they live. This difference is connected with a peculiarity of organization; for the warm-blooded have a heart with two auricles and two ventricles, but the cold-blooded only a single ventricle, and usually but one auricle. The mammalia are distinguished from birds, in being viviparous, or bringing forth their young alive, while the latter are oviparous or produce theirs from an egg. Of the cold-blooded, one class respire by lungs, the reptiles, or amphibious animals; the other by a substitute for lungs, the *branchiæ*, or gills.

The five classes of invertebral animals have been subjected to similar distinctions, though not strongly and satisfactorily marked as in the first division. They are divided into the classes which have vessels, and those destitute of them. The first are the mollusca, crustacea, and worms; and the second, said to be without vessels, the insects and zoophytes. The mollusca are peculiar in having simple or strait vessels; the

crustacea, for their articulated limbs; and the worms, for wanting these articulations. The insects have articulated limbs, but are not known to have vessels for circulating the blood, except a single one, called dorsal. As, however, their organization is in other respects complicated, for they have various organs for digestion, a very distinct respiratory system, and an elegant muscular apparatus, it is not improbable that other circulatory vessels may hereafter be discovered. The zoophytes have neither vessels, articulated limbs, nor, so far as is known, a nervous system.

The first of the nine classes of animals, MAMMALIA, comprehends the varieties of man, and orders of quadrupeds. This arrangement, however offensive it may be to our pride, is required by a close resemblance in the anatomical structure of bones, muscles, and other parts; and by as remarkable differences in many particulars between this and the other classes. LINNEUS thought proper to place man in the same order even with monkies, lemurs and bats, on the ground of their possessing in common the front or incisor teeth, in which they differ from all other animals. This approximation is not justified by a comparison of the structure and habits of these quadrupeds. The bats are in many things different; the lemurs and monkies are peculiar for having an opposing pollex, or thumb, on the feet as well as the hands, whence they have

been called *quadrumanes*, or four handed; while man is truly *bi-manis*, or two-handed. These two genera differ from man in being endowed with a tail, and particular vertebræ to support this part; to which the human race have in reality no claims, notwithstanding some philosophers have attempted to establish such a pretension.—Neither these nor any other quadrupeds have such a structure of the pelvis and lower, or posterior limbs, as to admit of their walking steadily and constantly in an upright posture; so that man, although belonging to the same class as quadrupeds, may fairly be placed in a separate order.

As the monkey tribe approach nearest in structure to man, it is proper to begin our comparison of the sensorial system with these animals; and as the brain is the principal organ of this system, we shall compare this part first, and afterwards the nerves.

The human brain, you will recollect, is composed of a cerebrum and cerebellum, pons varolii and medulla oblongata. The surface of the cerebrum is divided by a deep fissure into its two hemispheres, and is indented by many furrows separating its convolutions. Between the hemispheres lies the corpus callosum. At the lower part or base, we observe the six lobes and various smaller protuberances. In its interior are seen the corpora striata, or central nuclei of the

cerebrum; behind these the optic thalami, tubercula quadrigemina and corpus pineale, or pineal gland. We notice also the three cavities of the ventricles, containing a number of minute parts; and lastly, a distinction of substance into exterior or cortical, and interior or medullary.—In the cerebellum we find, externally, two lobes, an appendix, and transverse eminences, analogous to the convolutions of the cerebrum: internally, a ventricle communicating with the ventricles of the cerebrum, and the distinction of cortical and medullary substance. In the medulla oblongata are seen the remarkable eminences, called anterior and posterior, corpora pyramidalia, and corpora olivaria.

The brain, in the most perfect *monkies*, has a form more circular than that of man, and also more flattened from above downwards. The middle lobes of the cerebrum are larger in proportion, while the whole bulk of the organ is considerably less. In other respects it has the closest resemblance to the human brain, for it possesses, without exception, all the parts belonging to the latter. Tyson, who has described the ourang outang, and is admitted as the first authority on this head, gives us the following statement. "The figure of the whole brain in our pigmy was globous; but by means of a greater jutting in, of the bones of the orbit of the eye, there was occasioned a deeper depression in the

anterior lobes of the brain in this place, than in a man. As to other circumstances here, I observed *all parts the same.*"* These are the only animals which resemble man in having the cerebrum prolonged into a posterior lobe; in having the tubercula quadrigemina bear the same relative proportions to each other and to the rest of the brain; in possessing the digital cavity of the lateral ventricles, and in having the olfactory nerves separated from the base of the brain. The organ is therefore alike in man and monkies, with the exception of some variation in form, and a difference in magnitude.

In the other orders of the class mammalia, the brain differs from the human in some important particulars. Its form is more flattened, and the convolutions on its surface less indented, except in the cetaceous or whale tribe, in which the cerebrum is both broad and elevated, and the convolutions deeply furrowed. The most remarkable variation in the mammalia consists in the deficiency of the posterior lobes of the cerebrum, and consequently of the posterior horns of the lateral ventricles. The base of the brain presents a tubercle under the anterior lobes, called by the ancients the mamillary caruncle, from which proceeds the olfactory nerve, containing a cavity or ventricle, connected with the

*Anatomy of a pigmy. p. 56.

cavity of the lateral ventricle. This structure does not exist in the human brain. In other respects the organ resembles that of man, in the composition of its parts, varying in different orders of the mammalia in the form and magnitude of its eminences, and in the depth of the corresponding depressions. It is worthy of notice that the eminences called *nates*, or anterior tubercula quadrigemina* are uniformly small in carnivorous animals, compared with the posterior tubercles, or *testes;* while in the herbivorous the nates are large in proportion to the testes, and thus approach nearer to the human structure. It may be stated as a general fact, that the magnitude of the human brain, relatively to the rest of the body, exceeds that of other animals; though not without remarkable exceptions, to be noticed hereafter.

The distribution of the cerebral blood vessels in quadrupeds, in most respects like that in man, has one peculiarity finely illustrating the use of the tortuous course of the great arteries to the human head, and showing the providence of nature for inferior beings. Quadrupeds carry the head more nearly on a line horizontal to the heart than man, and of course the blood is not so much retarded in its passage to the brain by the influence of gravitation. Its impulse on the delicate vessels of this organ would often pro-

*More properly called bigemina.

duce apoplexy, especially when the head is inclined to the ground, were not the force of the blood diminished by a peculiar arrangement. The carotid arteries, as they go to the brain, are divided into a multitude of small and interrupted branches of a net-work form, hence called by GALEN "rete mirabile." These afterwards unite to form single vessels which are distributed, as in man. All quadrupeds do not possess this structure. In the horse the carotid arteries bend into deep cavities, communicating together by transverse branches; and thus the ordinary pressure on the brain is diminished, while it may be suddenly augmented when occasion requires: for, says the anatomist WILLIS, "the horse, being born for war and hazardous encounters, requires magnanimous and ferocious impulses; it was necessary therefore that the blood should, when occasion demanded, ascend to the brain in a more full and copious torrent." This structure however renders the horse more liable to apoplexy than other qudrupeds.

In the class of BIRDS, the brain varies greatly from that of the mammalia, although it possesses analogous parts. The hemispheres of the cerebrum are considerable, constituting a large portion of the mass of the organ, and in their centre we distinctly see the corpora striata. There are two optic thalami, comparatively much larger than in man and quadrupeds. Behind the cerebrum appears the cerebellum, and from its in-

ferior part extends the medulla oblongata. The hemispheres of the cerebrum contain two lateral ventricles with an intervening septum; under the thalami is a third ventricle, and a fourth in the cerebellum, all of which communicate together as in man. There is no corpus callosum nor corpora mamellaria, nor do we see the tubercula quadrigemina between the cerebrum and cerebellum; but there are four tubercles placed between the thalami and corpora striata. The anterior part of the cerebrum is prolonged into the olfactory nerve, thus forming in this part a third degree in the scale from man; for in the human head, the olfactory nerves are distinct from the brain: in quadrupeds the brain swells into an olfactory tubercle; and in birds the hemisphere is prolonged into the olfactory nerve. The optic tubercles or thalami in birds are remarkable for possessing ventricles as the olfactory nerves do in quadrupeds. These facts would lead us to expect what we find to be true, an extraordinary development of the organ of smell in quadrupeds, and of that of vision in birds.

In the third class, the REPTILES, or amphibious animals, the structure of the brain is varied in the four different orders of *Turtles*, *Frogs*, *Lizards* and *Serpents*. The following characters are common to the four orders. There is a cerebrum with proper hemispheres, but no convolutions; a cerebellum and a medulla oblongata;

but the pons varolii does not exist. The optic thalami are found, the corpora striata, the pineal and pituitary bodies, the four ventricles with their communicating passages.—The brain in the *turtle* is of an oblong form, the cerebrum is indented transversely, the cerebellum is readily distinguished from the cerebrum. The anterior part of the hemispheres of the cerebrum is prolonged into the olfactory nerves: below these lie the optic nerves proceeding from their thalami, and between the two are tubercles like those in birds. The dura mater has a firmness almost cartilaginous. In the interior of the organ are found the corpora striata and the ventricles.

The class of FISHES is divided into *osseous* and *cartilaginous*. Considerable difference of structure is seen in these two divisions, and even in the families which compose them.—The general characters are these: the brain is always contained in a cavity much larger than itself, and surrounded by a liquid of a peculiar nature. Different from the other classes of vertebral animals, it is composed of a collection of tubercles, no one of which is very conspicuously larger than the rest. The two hemispheres of the cerebrum are distinguishable; behind them a cerebellum of nearly equal size; before them the two olfactory tubercles almost as large as the hemispheres; and below, the tubercles, or thalami, with the optic nerves. Besides these, there is

an eminence behind the cerebellum; various tubercles at the base, giving origin to nerves; the pineal and pituitary bodies; the tubercula quadrigemina, and the four cavities of the ventricles. The interior of the hemispheres exhibits the corpora striata; but the interior of the cerebellum wants the arbor vitæ, as well in this as the preceding, or reptile class.

Having compared the great sensorial organ in man with that in the other classes of vertebral animals; it might be expected I should proceed next to an examination of the same part in the invertebral classes. But in these last, the brain differs greatly in its relative magnitude, and in the complexity of its organization, from that of the superior classes; for in most instances it appears more like the enlargement of a nerve than a distinct organ, and often it is very difficult to discriminate it from those swellings of nerves called ganglia, which form so conspicuous a part of the nervous system of invertebral animals. Any separate description of the brain would be impracticable; and it must therefore be described in connection with the nerves.—It will be proper now to take up the second part of the sensorial apparatus, THE NERVES OF SENSE, beginning with the superiour animals; and afterward to trace the nervous system down through the nine classes to the most simple structures of the animated creation.

The nerves in the human body are white cords issuing mostly from the brain and spinal marrow. At their origins they are soft; through their course they are rendered firm by a membranous coat called neurilema; their terminations are generally unknown. The membranous substance which envelopes them, penetrates and separates them into a great number of filaments, each containing a soft matter considered as medullary, and possessing the peculiar properties of the nerve. In their course through the body, the nervous cords are interrupted by *plexus* and *ganglia*. A plexus is a network formed by the union and separation of a number of nerves. A ganglion is a body composed apparently of a yellowish or grey coloured unctuous substance. Within this there are, according to many anatomists,* a multitude of small filaments, uniting and separating, in the manner of a plexus, covered by the unctuous matter. Ganglia are found in all animals which have nerves; and they are seen to increase in comparative magnitude as we descend to the lower classes. In worms and insects they are more conspicuous than the nerves connected with them, and their number is also greater relatively than in the superiour animals. Their use has been a subject of specula-

* Scarpa *de Nervorum Gangliis et Plexubus. In Annot. Anatom.*

tion among physiologists; some viewing their functions as analogous to that of the brain; others, as Gall and Spurzheim have hazarded the opinion that they are the matrix or source of nutrition for the nerves and that the brain itself is to be considered a ganglion.

The opinion that the ganglia serve to nourish the nerves is derived from the structure of the lower animals. Dr. Gall states that he has observed in them two kinds of nervous substance; a greyish gelatinous matter and the nervous filaments. The first almost wholly composes the polypi. In animals a grade higher, the viscera are provided with masses of this gelatinous substance, and the nervous filaments are seen to arise from it.*

If it is intended to say that the ganglia of invertebral animals are like those of man, the ex-

* Nous avons observé, dans les classes inférieures d'animaux, deux substances du système nerveux: la substance gélatineuse grisâtre et les filets nerveux. La première semble former la presque totalité des polypes et characteriser le commencement du règne animal, quoique l'existence des filets nerveux, n'ait pas encore pu être démontrée dans ces êtres. Dans un degré plus élevé, les entrailles sont pourvues d'amas particuliers de cette substance gélatineuse, et on voit distinctement des filets nerveux, y prendre naissance; ceux-ci se rendent dans leurs parties respectives et s'y épanouissent. Mais comme ces amas de substance gélatineuse forment des noeuds ou des renflemens avec les nerfs qui y naissent, on les appelle des ganglions. (*Anat. et Physiol. du Système nerveux. Tom.* 1. *p.* 44.)

actness of this opinion may be questioned. The ganglia of invertebral animals are not composed of an external unctuous substance; nor do they present an appearance of nervous filaments within. So far as I have observed, they are firmer externally, and are covered with a white coat or neurilema like the nerves. Within this is a soft medullary matter, homogeneous in appearance to the naked eye, mottled when examined by the microscope; but in no respect resembling the greyish or yellowish matter of human ganglia.—Nor is there within this matter any thing like the nervous filaments. The nerves connected with the ganglia in these animals disappear at the coat of the ganglia, and do not pass through these bodies.

Should it be said that the colour of the internal matter is not important, and that this is the substance which nourishes the nerves, all that can be answered is that it has every appearance belonging to nervous matter; and that if it nourishes the nerves, then the nervous matter nourishes nervous matter, or in other words, nervous matter nourishes itself.

Had it been asserted that the coats of the ganglia in invertebral animals form the medulla of the nerves, the apparent structure would have better supported such a position. But this, although it would have given a use for the ganglia, would not have made it more probable that the

medulla is formed by the coats of the ganglia than by the coats of the nerves.

The supposition that nervous matter is diffused throughout the bodies of the gelatinous zoophytes cannot be supported by observation is contrary to analogy, and does not accord with the low state of the sensitive phenomena in these animals.*

The most probable conjecture as to the use of the ganglia seems to be that they are points of nervous communication, in some respects similar to the arterial communications, as they serve to diffuse more equally the nervous influence, or to lymphatic glands which collect parts and change their mode of distribution.

The terminations of nerves are not well known, except in the instances of the optic and auditory, and perhaps the olfactory nerve. These end in a pulpy expansion; whence analogically we conclude that the other nerves terminate in a soft substance, and that this is very extensively diffused, since there is scarcely any fibre of a living body which does not afford proof of the existence of nerves. Mr. JOHN HUNTER thought the nervous influence to be uniformly spread through every texture: and Sir EVERARD HOME has supported this opinion by experiments and observa-

* An account of Mr. Home's observations is contained in the appendix.

tions tending to show that the nerves contain a mucous matter, serving as a medium to carry their influence from one part to another.*

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* The distinguished anatomist, Mr. CHARLES BELL, has published a paper in the Philosophical Transactions for 1821, part second, giving some account of the structure and functions of nerves, leading to a new arrangement of the system.

This author supports the opinion, that where various nerves from different sources go to one part, they perform different functions. The tongue, the larynx, and many other parts are supplied in this manner.

He divides the nerves of all animals into two kinds, one simple and regular, the other complex and irregular. The first contains all the spinal nerves, the suboccipital and trigeminus; all these are highly sensible. The second contains the respiratory nerves: which are 1. the par vagum; 2. facial, or respiratory nerve of the face; 3. spinal accessory; 4. phrenic or internal respiratory; 5. external respiratory, sent from the nerves of the neck to the thorax. These nerves are not very sensible.

The nerves of the face belong partly to one, partly to the other of these divisions; and of course have different degrees of sensibility and different functions. The branches of the trigeminus belong to the tongue, the salivary glands, the parts about the mouth, etc. and are highly sensible.—The seventh pair, facial, or, as Mr. BELL calls it, respiratory nerve of the face, differs in structure and function from the trigeminus. Its texture resembles that of the par vagum, being more dense than that of the other nerves. When this nerve was divided in experiments on animals, little pain was expressed, the muscles dilating the nose in inspiration were paralyzed and some of the face.—When the suborbitar branch of the trigeminus was divided, great pain was given and the upper lip paralyzed.

On a rapid glance of the nervous system in the various classes of animals from the highest to the lowest, we are struck with the fact that this part of the animal economy presents a greater

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As the trunk of the elephant is concerned in two functions, that of touch and respiration, it was examined with a view to ascertain whether it was supplied by different nerves, and it appeared that it possessed two large nerves from different origins.

The lungs and the muscles surrounding them are not the only parts necessary to respiration. Various other organs, some of them remote, concur in this function : all of them are supplied by nerves whose actions harmonize with each other and differ from those of other nerves. Further observations will separate the respiratory nerves in the body from other nerves, in the same manner as has been done in regard to the face ; and this will prepare for a new arrangement of the nervous system.

In the lower animals the respiratory nerves do not exist ; and therefore the symmetrical nerves are seen by themselves : the nervesof the back, for example, correspond with the spinal nerves and the trigeminus.

The observations I have made in surgical operations agree with those of Mr. Bell and his co-adjutor Mr. Shaw, and I think it a duty to record them. In four or five cases in which I removed the principal lobe of the parotid gland, the facial nerve, or many of its branches have been divided, and the muscles of the face on that side paralyzed. In the last and most formidable of these, the tumour involved the external carotid artery, which I divided and tied ; the nerves were of course extensively cut, the muscles of the face were paralyz-

uniformity in appearance and texture, in different animals than any other structure.

The particular distribution of the nerves, in the four classes of vertebral animals, is remarkably uniform, considering the difference in the external figure of these animals; but in the invertebrals is subject to great variations.

In vertebral animals, two great divisions are made of the nerves, first, those which issue from the brain, the nerves of sense, and second, those from the spinal marrow.

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ed; and when, after her recovery, the patient smiled, the muscles on the opposite side alone contracted; so that after the lady had discovered this peculiarity, I could never extort a smile till the paralysis began to diminish. It is also proper to remark, that in this case the patient was, soon after the operation, seized with a sense of constriction about the throat and larynx, that constantly threatened suffocation and alarmed me greatly for her life. This I attributed at the time to the division of branches of the par vagum; but as the symptom disappeared about the third or fourth day; it seems more likely to have been caused by a sympathy between the facial and laryngeal nerves. In this case as well as some others, I was surprised at the want of acute pain in the part of the operation when the nerves were divided: especially when I compared it with that of the operation for dividing the suborbitar nerve. In the latter, the pain has always appeared to be excruciating; in one instance a patient cried "you are knocking all my teeth out." After the division of the suborbitar, the face has not been paralyzed; but the upper lip has lost its sensibility on the same side.

In man, twelve pairs of nerves proceed from the brain, and the same number is found in the various orders of quadrupeds. They are also distributed nearly in the same manner, a large part to the organs of the external senses. In some animals of the class mammalia, the cetaceous or whale tribe, there is a remarkable exception to this arrangement, as will be noticed.—When speaking of the nerves belonging to the organs of the external senses, I shall ask leave to introduce some facts of comparative anatomy, relating to the organs themselves.

The first pair of nerves of the head or olfactory, in quadrupeds, arising from the lower and fore part of the cerebrum, is short, very thick, and contains a ventricle, which communicates with the cavities of the lateral ventricles of the cerebrum. In man and the monkies there is not any such ventricle in the olfactory nerve; nor of course in these is the organ of smell so largely developed as in quadrupeds. But in the latter, the face is prolonged anteriorly and has at the termination of the upper jaw two bones, not found in man, called inter-maxillary; whence it is that a more ample space exists for the organ of smell, as well as for that of taste. On this fact is grounded the remark of CUVIER, that instead of taking as the indication of intellectual superiority, the projection of the forehead and the facial angle, which are liable to inaccura-

cy from the thickness of the frontal bone, we might substitute the surface of the nasal and oral cavities, seen in a vertical section of the head; for as the superficies of these two organs increases in proportion to the superficies of a section of the cranium, so do the organs of taste and smell predominate over the organ of intellect: and in this respect there is a pretty regular gradation from man to the inferiour vertebral animals. There is a remarkable exception as to the olfactory nerve in one order of mammalia, the cetacea, or whale tribe. They are entirely destitute of this nerve and of the olfactory organ. A peculiarity more worthy of notice, because the other inhabitants of the waters, of the class fishes, possess the olfactory nerve and the organ of smell.

The second pair of the head, or optic nerves, exist in all the vertebral, as well as most of the invertebral classes, and are usually among the most conspicuous nerves in the body. They originate in man from the tubercles called *nates* and after passing some distance unite together, then separate and go to the globe of the eye, penetrate the sclerotic and choroid coats and expand on the inside of the latter, thus forming a third or interior coat of the eye, the retina. This nervous coat is composed of a most delicate membrane, covered internally by a pulp, the true nervous matter. The pulp, examined by the microscope, according to Sir E. Home, appears to

be composed of bundles of fibres, radiated from the optic nerve, and these consist of globules connected into fibres by a gelatinous substance, soluble in water, transparent during life, becoming opaque after death. The discovery of this transparent jelly is thought by Sir E. Home, to be very important, since, according to him, it will enable us to form some idea of the action of nerves.*

The retina, the expansion of the optic nerve presents very similar appearances in the four classes of vertebral animals. The other coats and humours of the organ of vision are also generally alike; but there are some peculiarities worthy of being noticed. The form of the pupil varies in different orders. In the graminivorous, or ruminating, it is horizontally oblong, for the purpose of enabling the animal more readily to discover its food on the surface of the earth; while in the carnivorous it is vertical, and thus keeps sight of an object, during the vertical changes of position that occur, when these animals leap on their prey. In some of the ruminating, there is a muscle, not found in man, called suspensorius or retractor, extending from the back part of the orbit to the globe of the eye. By its contraction the globe is drawn into the socket; an action, we may suppose, destined by

* See Appendix.

nature to prevent injury to the organ, when exposed during a rapid course through forests.

The optic nerve and organ in the second class present some interesting peculiarities. Birds are mostly feeble animals, liable to become the prey of others, yet possessed of peculiar means of security, by flight. In order to enable them to employ these means usefully, a keen and extensive sense of vision is required. Their optic nerves are large and connected with thalami or tubercles, which have ventricular cavities. The eye is so prominent on the side of the head, as to discern objects before and behind, as well as those in a lateral situation; and might therefore be exposed to injury, were it not protected by a range of lamina, or scales, encircling it at the circumference of the socket. The cornea is firm, very large, and receives additional protection from the *membrana nictitans*, a third eyelid placed at the inner angle of the eye, and capable of being expanded over the cornea by means of two muscles, extended from the back part of the sclerotica and by their action drawing the membrane toward the outer angle. The membrana nictitans is a fold of the conjunctiva, it is thin and therefore does not wholly intercept the passage of light. In water-fowl it is drawn over the eye, when the head is plunged into the water to seize their food; and it enables those which soar high in the air to support without inconvenience the full blaze of

the sun. The coats and humours are, as already mentioned, similar to those of the mammalia; but there is an additional membrane at the back part of the cavity of the eye, which perforates the retina and extends forward, almost to the crystalline,in some species. This,from its purse-like shape, is called *marsupium*. It is covered with a black pigment like the choroid membrane, and has therefore been thought to have, for its use, the absorption of superfluous rays of light, to which these animals are peculiarly exposed. The aqueous humour in birds occupies an ample space, but the crystalline is of small size. To these facts we shall have occasion to refer hereafter.

In the fourth class, the fishes, the optic nerves have a peculiarity of course, which throws light on an obscure point of human physiology. In man and other mammalia, these nerves, after coming from the brain, approach each other and form a union into a common mass. It has always been a question, whether they cross each other, or whether they are perfectly united in this mass : a question which anatomical researches have not satisfactorily answered. In fishes, the optic nerves, after issuing from their thalami, lie one over the other, for some distance, without any union, though they are loosely connected by transparent cellular membrane; and at length that of the left side goes to the right eye, that that of the right side to the left eye. Here is a

distinct and remarkable instance of a nerve from the left side of the brain, going to an organ on the right side of the head. Although we do not know the reason for this arrangement, it must, I think, be admitted that the more extraordinary it is, the more likely is it to be connected with some important law of vision, and the stronger ground have we for believing that the same structure exists in man.

The globe of the fishes' eye is covered externally by a thick and strong membrana conjunctiva, serving as a substitute for eyelids, and protecting it from the water. The membranes, choroides, and retina, consist of more than one layer, and thus seem to differ from the eye of the mammalia; but the observations of some anatomists give us sufficient assurance that the retina has two layers, a membranous and nervous; and there is reason to believe that the choroides has the same number. There is in some fishes a marsupium, of smaller size than that of birds. The iris is externally covered by a silvery coat, while its inner surface is endued with a black pigment, to absorb the rays that might penetrate it. In the humours of the eye, nothing remarkable appears in the vitreous; the aqueous and crystalline exhibit peculiarities, well fitted to excite admiration.

The aqueous humour is ample in BIRDS, as before stated, and acts an important part in the vision of these animals; for as they reside in air

and sometimes soar to its thin upper regions, they are of course situated in a medium, rarer than the fluid, composing the aqueous humour. Now we know that light, in passing from one medium to another, suffers a refraction proportioned to the difference of their density; but the water of the aqueous humour is denser than air, and, being of great extent in birds, must cause a considerable refraction in a direction fitted to bring the rays to a focus; and, what is worthy of particular admiration, the more elevated the animal's flight, and consequently the more remote the objects of vision, in so much more is the refraction augmented by the increased rarity of the air, and consequent increase of difference in the media, through which light passes to the eye. The *crystalline lens* is small in birds, and contributes but moderately to the approximation of the rays of light; because the refractive power of the aqueous humour diminishes the importance of the crystalline.

Fishes, on the other hand, live in a fluid equally dense with the aqueous humour, which can, of course, have no power of refracting the light. Nor could the density of this humour be increased without depriving the iris of a bed proper for its movements; it is therefore no larger than is necessary to admit the iris to float freely in the operations required for increasing and diminishing the aperture of the pupil. The crys-

talline lens is destined to perform the refraction of light. It is large, possesses the greatest degree of convexity, and has, of course, a high refracting power. This power is increased by the internal structure of the lens; for while, like the human, it is soft and gelatinous externally, its nucleus is very hard, so as to yield with difficulty to the knife. The difference of density, between its exterior and interior, the difference between the whole lens and the water, together with the convexity of the lens, give it probably the highest refracting power which a single body can possess, and thus the animal has an adequate degree of vision, notwithstanding the density of the medium in which it exists.— By recent experiments and observations of Dr. Brewster, it appears that the difference of density, between the nucleus and exterior, serves another purpose in the vision of the inhabitants of the deep.* This philosopher noticed that the polarization of light is remedied, or in other words that light is depolarized by substances of unequal density, as hardened jelly or glass cooled in such a way as to possess unequal densities in different layers; whence he was led to conclude that the crystalline of fishes possessed the same power; and on examination his suspicion was found to be confirmed. The depolarizing pow-

* *Philosophical Transactions.*

er, we may suppose, has under these circumstances the effect of bringing the light more truly to the eye, and presenting objects in their proper place.

The comparative view we have taken of the structure of the nerve and organ of vision in man, birds, and fishes, must, I think, inspire us with high notions of the wisdom of the creative power. Such views may serve also to teach us a modest estimation of our own abilities; for while we are surrounded by phenomena, whose ultimate objects are wrapt in impenetrable obscurity, nature sometimes lifts the veil, which conceals her designs, and indulges us with a full view of their utility and beauty. Whenever, therefore, the mystery of final causes eludes our research, we ought not fall into a despairing skepticism; we should be contented with what is unfolded to our view, and believe that what is unintelligible is not less wisely and wonderfully formed.

The other nerves of the head are much the same in number and arrangement in the four classes of vertebral animals; varying so far as the difference in the form of the head requires. The fifth pair possess a greater number of branches in birds and fishes; while the eleventh pair, or sublingual appear to be wanting in fishes, the deficiency being supplied probably by the additional branches of the fifth, since in the

mammalia we know that these nerves both send branches to the tongue.

The spinal division of nerves contains, in the human subject, about thirty pairs. Issuing from each side of the spinal medulla, between the bones of the spine, they correspond in number with these bones, not only in man, but in the four classes of vertebral animals. Quadrupeds, having the same number of vertebræ of the neck as man, possess the same number of cervical nerves, seven, except a single species, which has two additional bones and nerves. The dorsal vertebræ and nerves are generally more numerous. The neck in birds is long; their cervical vertebræ and nerves, of course, are numerous, amounting in some genera to twenty; their bodies being short, the dorsal nerves are always fewer than in the mammalia. Some of the reptiles, as the serpent order, present a vast number of vertebræ and corresponding nerves. An analogy in distribution is striking in all the classes; even in fishes, where there are no limbs, we yet perceive a nervous network supplying the place of the brachial plexus, whence nerves are sent to the pectoral fins; and as the abdominal fins are the parts analogous to the inferior extremities of man and posterior extremities of other vertebral animals, they have nerves sent to them in a similar way from the spinal mar-

row, though more in number in some fishes, than in the other classes of animals.

A proper *phrenic* nerve has not been discovered in birds, reptiles, or fishes. The *great sympathetic*, with its ganglia, is seen in all the mammalia, birds, and reptiles; but in fishes it is a very small nerve without ganglia. Perhaps the size of the spinal marrow, the number and magnitude of the nerves which proceed from it, their proximity and connexions with each other supply the place of the great sympathetic.

INVERTEBRAL ANIMALS.

The invertebral animals are so called from being destitute of vertebræ, and of course of an internal skeleton. As in this they differ greatly from the vertebral animals, so in other particulars are they widely dissimilar. In the form of the vertebral animals the same type is distinguishable in all the classes; but in the invertebrals there is no resemblance to the superiour animals in external appearance, nor do the different classes resemble each other, nor even do the different orders of the same class. The variety in structure is equally great. Instead of an internal apparatus of bones, they have an external coat of various firmness; in some of stony hardness, as in the oyster, and other shell

fish; in some it is a crust as in the lobster, and most insects; in some it it is a strong yet soft substance, as in the cuttle fish; while in others this covering is thin and membranous, as in worms and many polypi. Their internal organization also differs from that of the vertebral animals.—The organs of the circulation are generally very simple and few in number. In the polypi, there are neither arteries nor veins; but merely vessels which absorb nutritious matter from the stomach and convey it to every part. In insects there appears to be a single vessel, called either a heart, or an artery. In worms, there are arteries and veins, to the number of three or four.*

The respiration of these animals is never performed by lungs, unless we should consider to be such certain vesicles existing in the arachnides or spiders, and in the red-blooded worms. The mollusca and crustacea breathe by *branchiæ*, or gills, like fishes; insects, by *tracheæ* and *stigmates*, that is, air tubes and air holes; worms and polypi by orifices or pores of the skin.

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* In crustacea and many mollusca we find one or more hearts; the sepia has three, one middle and two lateral. Each heart has a ventricle, one and sometimes more than one auricle, and corresponding arteries and veins.

The nervous system also differs greatly from that of the vertebral animals. As there is no spine, there is, of course, no proper spinal marrow. The brain is wanting in almost all the classes, and instead of it, there is a nervous mass, surrounding the œsophagus, thence denominated the *collar*, from which *nerves are sent* in various directions. In four of the five classes, the principal nerve from this *collar* is the most conspicuous nerve in the body; and is very uniform, in having a number of ganglia placed along it, at nearly equal distances. The fifth class, or zoophytes are apparently destitute of nerves.

The invertebral animals compose by far the greater part of the animated creation: and from their number as well as from the varieties of their form and the obscurity of their structure are objects of great interest to the naturalist. They have been divided into five classes, MOLLUSCA, CRUSTACEA, INSECTA, VERMES, ZOOPHYTA.

The MOLLUSCA are placed first among the invertebral animals, because their structure is the most complicated. The name is taken from the soft consistence of their bodies; yet we must admit it to be an unfortunate term as applied to this class. No one would expect to find that animals covered with strong shells, as all the testaceous animals, were to be found in a division denominated from their softness. Their bodies are in fact soft,

though the part which covers them is hard; but the term applies with more exactness to a different class, the zoophytes. A more important objection may be made to the arrangement, than to the name. This class comprehends not only animals with soft and with hard coverings; but also such as are different in structure and habits. The cephalopode mollusca have a complicated organization; while that of the testacea is comparatively simple. In the genus sepia, belonging to the former, we find a distinct and extensive nervous system, various organs of sense, hearts with arteries and veins, many articulated limbs, and a power of free loco-motion. In the testacea, the nervous system is obscure, there are no distinct organs of sense, the heart and vessels are small, there are no limbs, and in general almost no power of loco-motion.

These facts have led M. Cuvier to divide his molluscous animals into six classes, thus separating from each other, in some instances, animals much alike in structure. M. Lamarck, while he makes objections to the arrangement of Cuvier has also divided the mollusca into a number of classes, in a different manner from the latter, and placed them in his primary division of *sensitive animals*. If to these opposing facts and opinions we add that the researches of M. Savigny have lately shown that a number of the minute animals, considered as zoophytes, have a complicated

ructure and are really mollusca; moreover that is probable many of this class will hereafter be ound to have a similar structure, it must appear that the arrangement of this part of the nimal kingdom is yet unsettled, and liable to nany changes, on further discoveries.

For our present purpose, it will be sufficient to give an idea of the nervous structure of the two orders called cephalopoda and acephala. The *cephalopoda* have heads, with many legs placed around. The acephala are without heads.

The most remarkable of the cephalopoda are the sepiæ, the species of which called sepia officinalis, or cuttle fish, is pretty generally known. They vary in size from a few inches to a considerable magnitude.* They have a cartilaginous head, surrounded by eight legs; and some of them have two tentacula, or feelers, longer than the legs; two large eyes, ears, a central and two lateral hearts with blood vessels, a complicated digestive and generative apparatus; and they are invested by a firm cloak or mantle, which contains a bone.

The nervous system of the sepia approaches to that of some vertebral animals on one side and to that of the crustacea on the other: the resemblance to the latter is stronger than to the same system in other animals of the same class, that is, to the acephalous mollusca.

*The accounts of enormous sepia are not credited by M. Cuvier; nor are they supported by satisfactory testimony.

The brain is situated in a cartilaginous ring, a part only of which it occupies. From its sides issue two nerves to form the *collar*, around the esophagus. The optic nerves proceed from the brain to the eye, and there form a ganglion, nearly equal in size to the brain, sending out innumerable filaments to the coats of the organ of vision. The collar is a flat nervous mass, furnishing the legs of the animal with nerves, one to each; besides which there are many ganglia and nerves supplying other parts of the body. The most distinct and beautiful of these are placed on the inner surface of the mantle about the middle of the back; they are two in number, one on each side. A long nerve from the collar gives origin to them, and on every part they radiate small nerves which give them a resemblance to the sub-maxillary ganglion in the human head. The organ of vision is very complicated and beautiful; that of hearing is of simple structure; the tentacula possess the sense of touch; and as the animal has a mouth and tongue it probably enjoys the sense of taste.

In the acephalous mollusca a very different nervous apparatus exists. The brain, if it can be so called, is placed on the esophagus under a sort of cap or hood, formed by the soft mantle which lines the shells. Connected with it is a very considerable nerve running within the mantle almost round the shell; from this, nervous filaments are

sent to the liver, heart, especially to the branchiæ and to the fringe about the mouth. There are also ganglia connected by nerves with the principal nerve, one is situated near the brain, another on the muscle which closes the shells.*

The CRUSTACEA have received their name from the crust or hard coat which invests them. By LINNEUS they were placed in the class of insects. CUVIER admitted them formerly to rank apart from insects; but since his new arrangement, the crustaceous animals, though made a distinct class, are placed in the same division with insects, under the head of ANIMALIA ARTICULATA. Such an authority as M. CUVIER is hardly to be questioned on any point of natural history or comparative anatomy; yet it must be admitted that the propriety of this approximation is at least doubtful. The crustacea are generally of great size compared to insects; a character not indeed important by itself, but which, taken in connexion with other distinctions, is not to be passed over in forming arrangements agreeable to the order of nature. Their habits are different; the insect tribes mostly living on the earth and in the air; crustaceous animals mostly in the waters, approaching in their habits to fishes. The organization of the crustacea is more complicated than that of insects. The former breathe by branchiæ or gills, the latter by air vessels.—

* See plate II. Ostrea edulis, the oyster.

The crustacea have a heart, arteries, and veins; insects only a single vessel. The principal common characters are articulated limbs and a knotted nervous system, that is, a principal nerve with ganglia placed at small intervals.

The nervous system in the different orders of CRUSTACEA is formed on much the same general plan; as from its distinctness it is readily examined, is well fitted to give a notion of the arrangement of the nervous system in other invertebral animals, and of the difference between this and the same system in the vertebral animals, I shall describe it more minutely. For greater exactness we shall take one species as the subject of our description. The *cancer gammarus*,* common lobster, has a small head placed at the root of the antennæ, or feelers; its situation is readily discovered by the eyes, on its fore part. Behind the eyes lies the brain, small, yet very distinct, and divided into two lobes. From the anterior part of the lobes, the optic nerves proceed to the eye. This organ is of an oblong form, rounded anteriorly, where it appears of a dark colour. The cornea is hard and fixed in a sclerotica connected with a membrane, the softness of which allows the organ to be drawn inward. The optic nerves, having entered the shell of the eye, form an enlargement whence

* (See plate I.)

proceed filaments to the choroid coat. The latter is of a purple colour, thick and soft; it is penetrated by filaments of nerves going to terminate on the inner face of the cornea.

The brain also sends anterior nerves to each of the four antennæ, the organs of touch. From its posterior part proceed the two nerves that surround the esophagus and constitute the collar. The organ of hearing receives its nerves from the collar; it is placed on the root of the great antennæ, and externally presents a membrane of a circular form, about a line in diameter, inserted in the shell; within this membrane there is a small bone, behind which we observe the expansion of a soft greenish substance, displaying a beautiful arborescent distribution of the nerves from the collar.

The most conspicuous part of the nervous system of this animal consists of two nervous cords, with many ganglia, extending through its whole length. These two cords arise from the posterior part of the collar, and passing along the stomach, form a ganglion, which sends nerves to the jaws: the two nerves, still running on in contact, form successively five ganglia, corresponding with the pairs of claws, and each claw receives a nerve, that penetrates to its extremity. After this, the two nerves unite and form six ganglia successively, extending along the tail and furnishing nerves, as they proceed, to

different parts, the last being distributed to the fins or swimming organs.

The CRUSTACEA therefore possess a brain, nervous collar, an oblong nerve, separable into two nerves, with ganglia, other nerves arising from the former, and three distinct organs of sense, that of vision, of hearing, and of touch.

INSECTS, the third class of invertebral animals, although various in form and size, present a great degree of uniformity in their organization. They differ from crustaceous animals in their organs of respiration. Instead of branchiæ, they breathe by tracheæ, two oblong tubes on each side the body, communicating with the external air by orifices, denominated stigmates. To this structure there is an exception in a part of the arachnides or spiders, which have vesicles, or bags, supposed to perform the office of respiration.—This fact, together with the want of antennæ, has led some naturalists to put them in a different class from insects. The *pulmonary arachnides* are also said to differ from insects in their organs of circulation; insects, possessing only a single dorsal vessel, serving for heart and arteries, while these arachnides have an oblong vessel considered as a heart, connected with lateral vessels which receive blood from it.

The nervous system of INSECTS preserves the same general characters in the variously formed animals belonging to their class. There is a

brain supplying nerves to the organs of sense, a nervous collar encircling the esophagus, whence proceed the two longitudinal nerves with ganglia, from which the nerves of the limbs are sent out. To this general arrangement there are some exceptions. Insects with bodies of a rounded form have their nerves distributed in a radiated manner, and the same may be said of crustaceous animals; while those with oblong bodies exhibit the appearances just described.— We shall select a single species in order to give some notion of the common distribution of nerves, in this class.

The centipede, scolopendra morsitans, is convenient for our purpose on account of its size and the distinctness of its nervous system.* The brain in this insect is comparatively of large size and of a rounded form. It sends two nerves forward to the antennæ, two others, the optic, to the organs of vision. Posteriorly issue two nerves which separate, surround the esophagus, afterward re-unite, and form a ganglion on the first ring;† from this issues a nerve, which divides; then another union is formed and another ganglion on the next ring, and so of the rest.—

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* Plate 4.

† The rings are circular crusts, corresponding in number with the pairs of legs.

From each ganglion, three pairs of nerves proceed; one pass forward, the second laterally, the third backward, and from them the neighbouring muscles, viscera, and limbs are supplied. The nerves of the larva in the winged insects are larger than those of the perfect insect. This fact appears less extraordinary, when we consider that in the young subject of the mammalia and other vertebral animals, the nerves are larger in proportion, than at a subsequent period when the body has reached its full growth.

The external senses are not wanting in insects. The organs of vision are usually large, often numerous, and are divided into two kinds, simple and compound. The compound eyes are so called from their surface being divided into a vast number of facettes like cut glass, which in some species have been computed to be 25,000, and to each of these goes a filament of the optic nerve. In various instances, the simple and compound eyes are found to exist together in the same insect. The sense of touch resides in the antennæ, which are, for this function, supplied with large nerves. The proboscis, or rather the tongue contained in it, is the seat of taste, when it exists; and when wanting, its place is probably supplied by some of the complicated parts which compose or surround the mouth.—No organ of hearing has been discovered; we are led to believe that there is a sense of smel-

ling, by the fact that they are able to find their food in situations, where it could be discovered by no other sense we are acquainted with.

The fourth class of invertebral animals, worms, VERMES, in the arrangement of LINNEUS comprised the three classes, mollusca, zoophyta, and vermes. CUVIER and LAMARCK have agreed in abandoning this as a class, placing one portion of it in a separate class under the name of *annelides*, referring the other, *epizoaria* to the zoophytes, or animalia radiata. The annelides have a more complicated structure than the epizoaria, are therefore very properly separated from the others, and are the animals we shall describe under the head of VERMES; for the epizoaria, the intestinal or parasitic worms, so called from growing in other animals, do not exhibit the same organization; their structure is extremely simple, and brings them properly among the zoophytes.

The annelides have received their name from the numerous rings composing their bodies.—They are very remarkable for being the only invertebral animals with red blood; and therefore form an exception, the only one, to the law formerly alluded to, which assigns white blood to the vast number of animated beings comprised in the invertebral division. This peculiarity might be explained in regard to some of them, which feed on the blood of red-blooded

animals, as some of the leeches; but such an explanation will by no means apply generally; since the greatest part of this class live on animals and vegetables affording fluids of a different colour from red blood, as the earth worm and most of the sea worms.

Separated from the epizoary worms, the annelides form a very small class. Their general organization is more complicated than that of insects, since most of them breathe by branchiæ, and possess a double system of sanguiferous vessels, performing the functions of arteries and veins. Their digestive apparatus is complicated and extensive; being composed of a mouth, esophagus, one, and sometimes many stomachs, an intestine, and an orifice for excretion.

For a specimen of the nervous structure in the class of red-blooded worms, we shall take an animal generally known, the leech, hirudo medicinalis.* Its nervous system is principally composed of a nervous cord knotted, with ganglia, extending the whole length of the body, *contained in and covered by the abdominal blood vessel.* The latter fact led M. Cuvier, I suppose, to say that the coat of this nerve is black, for the red coat of the blood vessel, which invests it, assumes a blackish appearance on immersion in alcohol: but the coat of the nerve, so far as I have noticed, has

* Plate 3.

the same white appearance as that of other nerves. The long nervous cord has twenty-two or twenty-three ganglia. The first, placed in the head, is small, and sends forward two nerves to the disk: it also sends two nerves backward, which separate, surround the esophagus, thus form the collar, and afterwards reunite in the largest ganglion of all. From this are sent out many nerves, lying near each other, and forming a nervous mass like a plexus near the esophagus and minute nerves are also sent to the mouth: out of the plexus proceed nerves along the animal, supplying various parts, particularly the cutis, cuticle and muscular expansion under the cutis, which performs the animal's movements. The principal or knotted nerve, passing a little distance from the second or large ganglion, forms a third, afterwards a fourth, and so to the number of twenty-two, when it terminates at the posterior extremity of the body. Each of these ganglia sends two pairs of nerves, to be distributed to the stomachs and other parts in their vicinity. The only distinct organs of the external senses are those of vision. There are five pairs of eyes, placed on the sides of the head, the two anterior being the largest. The sense of touch probably resides in the anterior pointed extremity; and although there is no apparent organ of smell, we cannot doubt the existence of the sense, on considering the sensibility, displayed by the

animal, to odorate substances. There is no reason to believe it has a distinct sense of hearing, although it may be sensible, through the medium of the skin, to those impulses of the air, which produce sound.

Zoophytes, the last class of invertebral animals, received their name from a supposed union of the animal and vegetable natures. In form, some of them have a great resemblance to vegetables: but in other respects they are different; and especially are they to be distinguished from the vegetable world by the possession of a power of acting or contracting and generally a power of moving from place to place. By Lamarck they have been denominated *apathic animals*, from being destitute of sensibility: for their motions do not, in his view, appear to be the result of the application of external stimuli, but rather to be instinctive. Cuvier has given to them the name *animalia radiata*, because in most of them the parts are placed in a radiated form, around a common centre.

This class is composed of animals, the greater part extremely minute, yet inconceivably numerous, and by their aggregation sometimes producing masses of vast extent. In order to give some idea of these singular beings, we must say a few words of each of their different orders. The *infusory* animals, seen in vinegar and in stagnant water, are the most minute of the animated king-

dom; for many of them are only to be discovered by the microscope. Their structure has the greatest simplicity, so far as we can ascertain it; no other part being distinguishable than a sac, various in form, with one opening for the reception and rejection of alimentary substances. They have neither vessels, nerves, nor internal organs. On examination by the microscope, they present a great diversity of curious forms, as those of globes, suns, comets, in truth almost every imaginable shape. Next to the infusory stand the *polypi*, animals larger and better known. They constitute the most considerable part of the zoophyte class and contain a great number of genera and species. The polypi are gelatinous animals with an oblong body. They have a mouth, surrounded by tentacula or other projections placed in a circular form; this orifice leads to a cavity occupying the interiour of the animal and possessing no outlet but the mouth. As they have no vessels for circulating fluids, they are nourished immediately by absorption from the interiour of their sac or stomach; while their respiration is probably performed by the external surface of the body. The best known of these animals is the hydra of fresh water streams, seen attached to the under surface of the leaves of aquatic plants. It has a green colour and a form difficult to describe. Fixed by one extremity to a leaf or stalk, it extends the other; by the tenta-

cula seizes insects and other substances approaching it, swallows them, digests whatever is adapted for its nourishment, and rejects the rest. The rays of the sun are agreeable to this animal and appear to influence its motions, and favour its increase. The mode of production is by the growth of an eminence from the body, which attains the form of the parent; in some separates, and in others lives in common with it, the different animals communicating together and receiving each a share of nourishment from what is taken by the others. The *vaginated polypi* are analogous to the hydra in their form, soft consistence, and the simplicity of their organization. They grow together in great numbers communicating by a common base. Although their organization is simple they have the power of covering themselves with a hard substance formed by exudation or exhalation from their surface. The nature of the substance varies according to the genus which produces it, and the corals, madrepores, sponges, gorgonias or sea fans, all are the productions of little polypi, springing from each other and afterwards forming these solid investments. In this way are formed the bodies of calcareous substance which pave the bottom of the ocean; and if, says the great naturalist LAMARCK, "they do not generate or produce the greatest part of the calcareous matter which exists, they are at least its principal collectors and deposit it in immense masses. In the

hot climates, especially, they influence the changes of coasts by increasing the inequalities of the bottom, and thus unceasingly modifying the surface of the globe. Sometimes they block up the entrance of harbours by erecting reefs and dikes impassable to vessels; and sometimes they raise islands in the midst of the vast plains of the ocean, which they continually increase in circumference and height."*

The third order of ZOOPHYTES is the RADIARII. Some of these are commonly known as the echinus, sea-urchin or sea egg; asterias, the star fish; and few can have failed to notice the medusæ, large gelatinous masses so numerous in our harbours and often seen dissolving on the shores under the influence of the sun. In the radiarii, the internal and external parts are arranged in a radiated manner. The stomach is somewhat more complicated than in the polypi, having on its sides many bodies of a vascular form, to each of which naturalists have given the name of coecum. Organs of respiration also are found in the *radiarii*. These are pores or tubes sucking water into aquiferous *tracheæ*, which act on the air and decompose its oxygenous portion. Other genera have reservoirs for containing air.*

* LAMARCK, *Système des animaux sans vertèbres.*

The fourth order of ZOOPHYTES is the *epizoaria*, or worms inhabiting and subsisting on animal bodies, as parasites. A small part of this order is independent of other animals. The structure of the epizoaria differs greatly from the red-blooded worms; for they have neither head, nor eyes, nor vascular, nor generative system. The intestinal worms have two orifices connected with the digestive canal; but in others, for example the hydatid, as in the simplest zoophytes, we find only one orifice serving the purpose of both.

None of the ZOOPHYTES exhibit a distinct nervous system. In some *radiarii* and *epizoaria* there are indeed parts bearing a resemblance to nerves; as for example in the asterias, a circle of soft white substance surrounds the esophagus; from this issue ten filaments, two for each of the branches which form the body of the star; the two filaments belonging to each branch, having reached the base of the bony articulated stalk, which serves as its principal support, reunite by a short cord passing directly from one to the other; they continue along the stalk to the extremity of the branch, constantly diminishing in size. At the place where they unite, a fasciculus of filaments is sent out which is distributed to the stomach, situated between the five branches. Such is the description of CUVIER;*

* *Anatom. compar. Tom.* 2. *p.* 360.

but he considers it necessary to perform galvanic experiments on these animals, before it can be determined whether the parts described are really nerves; especially as their appearance is rather tendinous than nervous. Not having examined any species of these animals which have appearances of a nervous system, I can say nothing on this point, from personal observation.

Thus have we attempted to give some idea of the sensorial and nervous apparatus in the different classes of animals. A comparison of this kind gives rise to many interesting reflections. Among the most obvious is the great similarity in the appearance of the nerves in all these animals, otherwise so differently constituted; for the muscular, vascular and other textures are constantly varying, while the nerves always present themselves in the form of strait, white cords. This observation cannot be applied to the brain however, since its form, size, and consistence present great varieties.

As the functions of this system in man are involved in obscurity, it is natural to inquire whether comparative anatomy, which has shed so much light on other parts of physiology, assists in solving any of the problems relating to this part of the animal economy.

The brain is thought to be the seat of the intellectual functions; the common centre of the

impressions transmitted by the nerves; some physiologists have believed it to be the source of the muscular power which it supplies through the nerves; and by some it is considered as not only the seat but the producing cause of the immaterial soul, which is supposed to be nothing more than the result of its collective operations.

The nerves are considered as the recipients of external impressions: those dispersed over the body receive the common sensations, and those belonging to the organs of the external senses receive the impressions of these senses, all of which they transmit to the sensorium commune, the brain. The nerves are believed by some to transmit to the muscles the influence which causes their contractions; this they either bring from the brain or generate themselves.

This is not the place to enter into a discussion of these subjects; all we have here to consider is, whether a comparative view of the sensorial and nervous systems in animals tends to strengthen or weaken any of these opinions.

In the first place, we are allowed, I think, to infer that the brain and nerves are not essentially connected in function; or, at least, that this is true in regard to the function of the nerves.—There appears to be no relative proportion in the magnitude of these organs in different animals. In man and most of the mammalia the bulk of the brain is considerable, compared to

that of the nerves; while in reptiles and fishes the *nerves* may compare in size with those of the superiour classes, but the brain is very small. The same is true even in different orders of mammalia; in the horse, for example, the brain is small, the nerves of great size.—Another fact bearing on this point is, that in the invertebral animals there is no proper brain: at least the organ we call by this name in the acephalous mollusca, crustacea, worms, and insects differs greatly from the brain of the vertebral animals, and is in truth little different from the ganglia. Yet in these animals the nerves are very distinct and even, in many large, in proportion to the other organs. Analogical reasoning is useful where we cannot resort to facts; but we would not have it applied too confidently, nor even without recollecting that the degree of belief due to it is lower than that belonging to fact.

In the second place, we may conclude that the brain is not the source of the muscular power. This conclusion is founded on a consideration of the disproportion in the size of this organ to the muscular strength of various animals. In the horse, the brain, as just stated, is small, the muscular vigour great; in the great sea shark, *squalus maximus*, the brain, compared with the body, is near the smallest among the vertebral animals; while the strength of the animal is so great that one of them has been known to drag a

vessel of seventy tons, under full sail, against the wind.

Third. It seems probable that the muscular power does not take its source from the nerves. The facts in support of this opinion are few in number, and the principal one is the non-existence of nerves in some animals capable of moving. In the gelatinous polypi and some other zoophytes no nerves have been discovered, and we are, from their texture, led to believe it impossible they should have any such nerves as other animals; yet they move, some of them with considerable rapidity.

Fourth. Many of the facts noticed tend to prove that the nerves receive the impressions of objects made on the external senses, and that by them these impressions are transmitted to the brain. It is not intended here to involve the hypothesis, that perception in the brain is caused by any kind of movement in the matter of the nerve; all that we wish to say is, that when the nerve expanded in an organ is affected by objects to which the organ is susceptible; it is in consequence of this affection that the brain perceives, and that, without the continuity of nerve, the brain cannot perceive. This has been thought to be satisfactorily proved by the suspension of perception, consequent on the division of a nerve; but those who maintain the opposite doctrine, consider the division of a nerve so far to impair

its perfection, as to render the experiment uncertain. If we look to comparative anatomy to determine these questions, we find that whenever an organ of sense is more than commonly developed, the nerve belonging to it, is sn the same degree developed in the organ. Further, that the size of the nerve before reaching the organ is always proportioned to the development of the nerve and organ; and that whenever a sense is wanting, the nerve usually going to the organ of that sense is also wanting. In birds, the sense of sight being acute, the optic nerve is largely developed in the organ, the size of the nerve before reaching it is considerable, and there is a ventricle connected with the nerve. We have before noticed the same fact in regard to the olfactory in some quadrupeds. Why should the optic nerve be of large size between the brain and the eye, except to transmit to the brain, the impressions received in the eye? In the whale, the organ of smell is wanting, the nerve, sent to it in other mammalia, is also wanting. In some birds, the organ of touch is placed at the extremity of the bill, and there is a correspondent arrangement of elegant nerves of the fifth pair. The same is true of certain quadrupeds, as the elephant, which has the sense of touch at the extremity of the trunk; and the ornythoryncus paradoxus, the duck billed animal of New Holland. In this singular creature most

of the qualities of a quadruped are united with some of those of a bird; and particularly it has a bill like a duck covered with a sensible membrane, which enables it to discover its food in the mud, where it could not employ the sense of sight; and the distribution of nerves accords with the peculiar situation of this sense.

The manner in which the nerves act in transmitting impressions to the brain, or causing perceptions in this organ is no more explained by comparative anatomy than by the numerous experiments and theories on nervous action.—Nor have we much reason to expect we shall ever be well acquainted with the functions of this part of the animal fabrick; though Sir Everard Home seems to think his late discovery of the mucous matter, connecting the globules of nerves, will throw light on its mode of operation.

Fifth. The brain is the common centre for receiving the impressions of the senses transmitted by the nerves, and is therefore rightly called *sensorium commune;* and where there is not a proper brain, the ganglion, which supplies its place, performs the same office.—In all animals with organs of external sense, the nerves belonging to these organs go from them to the brain. This is true not only in the more perfect animals, it is so in the mollusca, crustacea, insects, and annelides : with the inconsiderable exception that in some instances the nerves of an organ of

sense are connected with the brain, or substituted ganglion, through the medium of the collar, instead of being immediately so with the brain.

SIXTH. This comparative view of the sensorial system does not seem to support the opinion, that the difference in the intellectual faculties of man and animals is to be explained by a difference in organization alone.

This question involves considerations so important, that it appears proper to give it more attention than the others, especially as some ingenious physiologists have advanced this doctrine, and supported it by comparative anatomy. It is incumbent on us to inquire how far this science affords grounds for such opinions.

That there is a vast superiority in the intellectual powers of man over those of brutes, is a position sufficiently established by the opinion of the world, or in other words, by common sense. This opinion is also admitted to be just by a part of the most intelligent of those who support the doctrine, that these powers are altogether dependent on organization.

*"Mankind in general," says the ingenious Mr. Lawrence, "the unlearned and the scientific do not commit the gross mistake of confounding

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*Lectures on Physology, Zoology, etc. pp. 124, 126.

together men and animals; this distinction, at least so clear to common observation and unprejudiced common sense, is preserved in their short division of the animal kingdom into man and brutes."

"I do not hesitate to assert that the notion of specific identity between the African and ourang outang is as false philosophically, as the moral and political consequences, to which it would lead, are shocking and detestable."

"The peculiar characteristics of man appear to me so very strong, that I not only deem him a distinct species, but also put him in a separate order by himself. His physical and *moral* attributes place him at a much greater distance from all other orders of mammalia than these are from each other respectively."

Mr. White, the author alluded to in the above quotation, is one of the very few writers, who maintain the opinion, that there is a regular gradation in intellectual as well as physical qualities from man down to the lowest animal.* "The inferences, he tells us, to be drawn from the above facts and observations are these: That there is a general gradation from man through the animal race; from animals to vegetables and through the whole vegetable system. By gradation, I mean the various degrees in the powers,

* White *on the gradation of man.*

faculties, and organization." (p. 39.) "It can scarcely be denied that 'man differs more from man, than man from beast'—whether it proceeds from a difference in the quantity of brain or from any other source, there seems a difference in the original capacity of the different tribes of mankind." (p. 65.)

As a reason why animals of the monkey kind, the nearest allied to man, are destitute of speech, he quotes the discovery of Camper, that there is a bag lying in the neck which communicates with the larynx, and prevents, from a physical cause, as he appears to think, their attaining this privilege of the human race.*

Can such opinions as these quoted from Mr. White be seriously advanced, and do they demand a serious refutation? Is there an approximation in the mental powers of the highest order of brutes to the lowest races of man? Have we ever seen apes or other brutes approach men in the general course of their intellectual operations? An idiot man may be more stupid than a brute, and a madman more mischievous: but can we find instances of a number of brutes imitating men, even in the most degraded state, in the general tendency of their actions? Beavers build their cottages, parrots talk, monkeys perform

* P. 29.

the gestures of man: but do any of them carry on trains of reasoning, make inductions, store up the results of their reasonings, and communicate them to each other? If there is not a radical difference in the brute intellect, why do they not transmit their intellectual improvements to their posterity, and gradually elevate their race in the scale of beings? But while man has been increasing the stock of his knowledge from the time of our first father to the present day, brutes have remained precisely in the same condition, and with the same state of intellect, as when they originally came from the hand of the great Creator.

I suppose it is unnecessary to urge this point further, and that all who are not under the influence of a particular theory will agree, that there is an essential difference of mental faculties between men and brutes.

If then such a difference really exists; in order to make it appear probable by comparative anatomy, that the intellectual powers depend merely on organization, it must be shown that there is a correspondent difference in the organ which is the instrument of these powers.

On the other side, *the demonstration that there is no such difference, will deprive this doctrine of the argument drawn from comparative structure.*

It may be objected, that this course does not advance us in our knowledge of mind, nor its connexions with matter; to which I agree entirely.

The subject is beyond our powers, and the best we can do, is to avoid falling into errour, in the midst of the profound obscurity, which always has and probably always will darken this subject to human eyes.

The question now to be considered is, *Whether there be an essential difference in the brain of man from that of all brutes?* In a former part of this discourse, it has been stated that the human brain generally exceeds that of brutes in magnitude. A superiority in this point cannot however account for the difference in intellect, unless it be very remarkable and *wholly without exception;* and whether this be true will be considered hereafter. This fact alone, as we have admitted it, is not therefore sufficient to settle the question.

Physiologists, always anxious to discover in the brain a material cause for the superiority of man, have long sought for some point of excellence, peculiar to the human brain. They have not agreed what this is, or ought to be. Some have placed it in the magnitude of the organ; others in the magnitude of a single part, as the cerebrum or the cerebellum, or the medulla oblongata; and others seem disposed to make it consist in a general superiority in size, and structure. There is a discordance of opinions on this subject, which of itself leads to a suspicion that in no one important particular does the human brain, uniformly and without exception, differ from that of brutes.

The opinion which places the peculiarity of the human brain in the collective excellence of all its parts appears the most plausible; yet when we come to compare the organ with that of the nearest mammalia, this will not, I believe, be thought adequate to explain the difference of intellectual phenomena.

The monkeys, it is well known, approach nearest in structure to man. Those I have been able to examine, have been of the smaller species; but dissections of the ourang outang and others are found in the works of various anatomists, and on examination it will be seen that they bear a close resemblance to man in the structure of the brain.

In these animals are found the four principal parts of the organ, the cerebrum, cerebellum, pons varolii, and medulla oblongata; they have also the cerebral hemispheres, lobes and convolutions; the corpus callosum; the lateral, third, and fourth ventricles, and the minute parts within these cavities; the corpora mamellaria, olivaria, and pyramidalia; the pineal and pituitary bodies; the decussation of the pyramidalia. In short, they have all the remarkable eminences and depressions, belonging to the human brain. The principal differences observable are in the depth and number of its convolutions; and in its flatness, as stated in the description of the brain of the ourang outang.

These variations in the form and extent of parts which exist in both animals, are not such as would, I think, be called essential; and might be considered as less important than the absence of any one peculiar eminence.—It may be said that it is in the power of the Creator to make the smallest part of the brain the exclusive seat of the mind. This will be questioned by no one; but such a supposition would be hostile to the doctrine, that the perfection of the brain consists in the perfection of all its parts.

Let us next consider the brain in other animals of the class mammalia. All these differ from man and simiæ in wanting the posterior part of the cerebrum; that is, the posterior lobes of the organ, and consequently the posterior cavities, or horns of the lateral ventricles. Here indeed we find a striking variation of structure; and this, if it had existed in all animals but man, would undoubtedly have been fixed on as the material cause of the disparity of intellect; unfortunately for the material hypothesis, it is observed in quadrupeds and not in the apes, for the latter resemble man in this point of his organization.*

* We shall see in the history of the ourang outang, says Buffon, that if attention were paid to his form only, we might equally regard this animal as the first of monkeys or the last of men, because *with the exception of the soul*, he wants nothing that we have, and because he differs less from man as to body

If, again, it could be shown, on the one side, that the faculties of simiæ are nearly on a level with those of men; and on the other that the faculties of the rest of the brute creation are greatly inferiour to those of simiæ, then indeed, the want of the posterior lobe in quadrupeds would be a fact highly favourable to the material hypothesis, since its absence might be said to explain the inferiority of the latter, and its presence the equality of the former.

This inferiority of quadrupeds does not appear to exist. The elephant, many dogs, and some other animals, are nearly on a level with monkeys, in signs of intelligence, and the capacity of imitating human actions; and among birds we find one faculty at least, more perfect than in the quadrumanes, or quadrupeds, I refer to that of speech.

This general comparison does not on the whole present a decisive superiority in the parts composing the human brain, taken collectively.

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than he differs from other animals, to which the name of monkey has been given.

The soul, thought, speech, do not then depend on the form or organization of the body. Nothing better proves that it is a peculiar gift, bestowed on man alone, than that the ourang outang, which neither speaks nor thinks, has nevertheless the body, the limbs, the senses, the brain, and the tongue entirely like men; and that he knows how to imitate all his motions, and actions, and yet does not perform any human act.

(1. Buffon. *Histoire Naturelle. Nomenclature des Singes.*)

We must now proceed to examine in succession the particular points, in which the human brain has been supposed to excel that of all brutes.

The magnitude of the organ would naturally attract attention first, as the quality, most likely to form the grounds of a superiority in function. The consideration of this point of comparison is not free from difficulties; since a mere excess in bulk, would obviously afford no satisfactory conclusion, when it is observed that animals of small size are as intelligent as the larger; that the monkey with a small brain is not inferiour in sense to the ox with one of greater size;* nor man inferiour to the elephant which has the organ more voluminous than any other animal. It is not then by the positive magnitude of the part, that the question is to be settled; but by the size of the brain, compared with some other part. If we consider it in relation to the rest of the body, it will appear that the human brain is larger in proportion than in *most* other instances; but if there should be found a single exception it will be fatal to the doctrine that this relative magnitude is the cause of the superiority in mind.

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* Some of the monkeys have a brain weighing 4 or 5 ounces; that of TYSON, which is to be considered among the largest, weighed above 11 ounces. An ox of 1500 pounds weight, had, according to HALLER, a brain of two pounds. (*Elementa Physiologiæ. Lib.* 10. *Sect. de Cerebro.*)

Cuvier has given a table of the relative weights of the brain in man and other vertebral animals. In examining this it is proper to notice that in the *same species*, the relation will vary with the accidental size of the body; as in a lean man the proportion of the brain would be greater than in one charged with a quantity of fat; hence it is that physiologists have found a variation in man, from one twenty-third part to one thirty-sixth, if we take the table of Cuvier as a fair representation of the opinion of naturalists. This distinguished author has in regard to the human brain, introduced the facts contained in Haller. The Prince of physiology states that he found the proportion, as 1 to 22 in a boy six years old, at which age, it is well known, this proportion is much more in favour of the brain than in an adult; and the other proportions mentioned by him are $\frac{1}{23}$, $\frac{1}{33}$, $\frac{1}{36}$,* all of which are precisely the numbers, set down by Cuvier. We are therefore authorized to consider $\frac{1}{30}$ as the average proportion of the brain to the body in an adult.

Man	1:30
MONKEYS.	
†Gibbon	1:48
Saïmiri	1:22
Saï	1:25

* *Elem. Phys. Lib.* 10. *Sect.* 1. § 5.

† *Anat. Comp. Art.* 5. p. 149.

Ouïstiti	1:28
Coaita	1:41
Young Malbrook	1:24
Callitriche	1:41
Mone	1:44
Mongabey	1:48

QUADRUPEDS.

Mole	1:36
Dogs, different species	1:47
	1:50
	1:57
	1:154
	1:161
	1:305
Cat	1:82
	1:156
Beaver	1:290
Rat	1:76
Mouse	1:43
Field mouse	1:31
Elephant	1:500
Sheep	1:351
	1:192
Ox	1:860
Horse	1:400

CETACEOUS ANIMALS.

Dolphin	1:25
	1:36
	1:66
	1:102

Porpoise	1:903
BIRDS.	
Eagle	1:260
Goose	1:360
Cock	1:25
Sparrow	1:25
Canary birds	1:14
REPTILES.	
Land Turtle	1:2240
Frog	1:170
FISHES.	
Shark	1:2496
Carp	1:560

This table shows that five species of monkeys; the dolphin; and three kinds of birds, the canary bird, sparrow, and cock, exceed man in the proportion of the brain to the body; and that various other animals are nearly on a level with him. Of course it establishes the position, that we are not justified in attributing his intellectual superiority to an excess in the *bulk* of the cerebral organ.

HALLER has indeed said that the human brain is the largest among animals. "*Maximum inter animalia homini cerebrum esse." "Quadrupedum nullum hominem superat, pleraque infra eum sunt." But in this passage he merely intends to state the general fact, as immediately

* *Elem. Phys. loco citato.*

before he has given the above proportions of the sparrow, the canary bird, and those of a finch he was dissecting when he wrote: he also informs us that the pigmy of Tyson had a brain "certainly not less than the human;" and that the elephant's, though small in proportion to his body, weighs from 7 to 10 pounds, while the weight of the human brain, in a man of 140 pounds, is fixed at 4 pounds.

The facts already exposed would perhaps be sufficient to satisfy us that the desired peculiarity in the human brain is not to be discovered. Other comparisons have however been presented as the grounds on which an hypothesis might be erected; and as it may be believed we are ready to take for granted what ought to be proved, let us proceed to examine such as are most worthy of consideration.

The beautiful organization of the cerebellum, and the care with which nature has guarded it, more than the cerebrum, led former anatomists to the opinion of its being a more vital part than any other; and might have given it the pre-eminence over the cerebrum, as the seat of intellect; but that it is found to exist in almost all vertebral animals, even of the lowest orders, and that in a number of them, it has a ratio to the cerebrum greater than in man, as appears by the following table of Cuvier.*

* *Lib. cit. p.* 153.

In man, the cerebellum is to the cerebrum

as		1:9*
Saïmiri	monkeys,	1:14
Saï		1:6
Magot		1:7
Baboon		1:7
Dog		1:8
Cat		1:6
Mole		1:4$\frac{1}{3}$
Beaver		1:3
Rat		1:3$\frac{1}{4}$
Mouse		1:2
Hare		1:6
Boar		1:7
Ox		1:9
Sheep		1:5
Horse,		1:7

In the mouse it appears that the cerebellum is half the size of the cerebrum; and in most of these animals, the proportion of the cerebellum to the cerebrum is greater than in man.

As therefore this ratio could not afford a result favourable to the human brain; the position has been inverted, and the *cerebrum* considered as the part conspicuously larger in man.

The last table will show that the ratio of the cerebrum to the cerebellum, is more favourable than the other; yet not so much, as to give it an

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* According to WENZEL, 7$\frac{1}{2}$, *De Pen struct. Cer.*

exclusive superiority. In one species of monkey, saïmiri, it is greater than in man; and in a number of instances the ratio is the same and nearly the same, for example, in the ox it is the same; in the cat, various monkeys, and in the horse, it is nearly the same. Moreover, it appears by the observations of the Wenzels, that the cerebrum bears a greater proportion to the cerebellum in a fœtus of five months, than in an adult; and that the ratio lessens from that period to the end of the third year, after which it remains about the same during life.

The distinguished Professor SOEMMERRING has taken a view of the subject, which he considers more favourable to the human brain than any other.* In order to give importance to it, he first supposes that different parts of the organ are devoted to the intellectual functions, and to those of the external senses. Most of the nerves of the head are connected with the medulla oblongata, where of course he places the organ of the external senses. The rest of the brain is the organ of reflexion.—Some objections may be made to this hypothesis, besides the preliminary one that there is nothing distinct in its favour. The olfactory nerves take their origin, not in the medulla, but in the cerebrum, not-

* CUVIER, *Anat. Comp.* Art. 5, p. 153.

withstanding all the efforts of GALL and others, to trace them further. The motores communes cannot be followed into the medulla oblongata; and as to the optic, pathetic, auditory, trifacial, facial, and motores externi, it is not satisfactorily determined that they are to be considered nerves of the medulla, rather than of the cerebrum and cerebellum. Comparative anatomy affords indeed facts strongly in favour of the opinion that they proceed from the medulla, at least some of the last named; but these are cases susceptible of demonstration, and nothing short of a visible connexion with the medulla in man will determine, to the satisfaction of physiologists, that they originate from this part.

These are some of the objections to SOEMMERRING's opinion, that the medulla oblongata gives origin to the nerves of the senses and is to be considered as the organ of these senses. We now proceed to the comparison of facts.

The proportion of the brain to the medulla oblongata is estimated, says CUVIER, by the measure of their diameters, and gives the following results.*

The breadth of the medulla oblongata behind the pons varolii, to that of the cerebrum is

In man . . . . . 1 : 7

*Anat. comp. p. 153.

In the monkey, bonet chinois,	1 : 4
Short tailed macaw . . .	1 : 5
Dog	6 : 11
or	3 : 8
Cat	8 : 22
Rabbit	3 : 8
Hog	5 : 7
Ram	5 : 7
Stag	2 : 5
Cow	5 : 13
Calf	2 : 5
Horse	8 : 21
Dolphin	1 : 13

Some of the monkeys approach near to man in the ratio here proposed; and an insuperable objection to itexists in the dolphin; this animal having the proportion of the medulla to the cerebrum nearly double that in the human brain, and of course, on the hypothesis, an organ of reflexion twice the size of that in man.

The human brain has been said to exceed all others in the proportion of the medullary or interior to the cortical or exterior substance. How this is determined I know not: but it would require something more than the common section of the organ to establish this assertion, especially if we consider the errours likely to arise from the irregular distribution of the cortical matter. It is a common opinion that the cortical substance in the cerebellum is much greater in quantity than the

medullary. *Bichat has shown that this opinion is founded on a fallacious appearance, produced by the mode in which the section is made, and that the layer of cortical substance is less than in the cerebrum. Why may not the same illusion have existed in regard to the cerebrum; when sections have been made in various animals? If we admit however that the medullary matter is most abundant in the human brain, it must also be admitted that the disproportion is small; and that therefore it is not sufficient to account for the difference of phenomena. Further it is to be considered, that that this is merely opposing one hypothesis to another, since the cortical part has been formerly thought the more essential texture. Anatomists seem to have satisfied themselves, that the cortical is the most vascular portion, and have therefore been led to attribute to it the function of secretion, while that of conducting the secreted fluid has been given to the medullary; opinions founded on a supposed analogy to secreting organs like the kidneys. The texture which forms a fluid may be considered more essential than that which conveys it, therefore, the cortical is more essential to the function of the brain, than the medullary; and we might expect to find it predominant in the

*Bichat, *Anat. descript. Tom.* 3. p. 105.

human brain, contrary to the opinion abovementioned. I do not wish to attribute any importance to this analogy. The brain has no other resemblance to the glands than that alluded to; and in some respects differs greatly; especially it differs in wanting a visible excretory tube and a visible secreted fluid.—It is not to be doubted that the cortical and medullary substance are equally necessary to the operations of the brain, that they are of course worthy of the same rank, and that they bear a due proportion to each other in different animals; whether this proportion varies and how it varies does not appear to be well settled.

Sir Everard Home,* in his paper on the structure of the brain, very distinctly supports the opinion of the essential importance of the cortical substance on account of its vascularity; and seems disposed to rank it higher than any other part, except the pons varolii, the part connecting the cerebrum, cerebellum, and medulla oblongata. He is also induced by certain observations, to consider it as the seat of memory.

This learned physiologist is not the only one who has been disposed to assign definite parts of the brain as the seats of particular faculties.

Glaser placed the memory and will in the cerebellum; Willis, the imagination in the corpus

*See Appendix.

callosum; perception has been fixed in the corpora striata; reflexion and common sense in the medulla oblongata; instinct in the anterior tubercula quadrigemina; the passions in the pons varolii; judgment in the pituitary gland; GALL and SPURZHEIM have marked out portions of the brain as special organs of the powers, propensities, and passions; DESCARTES fixed on the pineal body, as the seat of the soul; and SOEMMERRING considers the ventricles as uniting the qualifications necessary for the residence of the spiritual principle.

Although many of these opinions are founded on analogies, none are capable of a distinct and satisfactory support from comparative anatomy, I believe, and to some it is decidedly hostile. The pineal body, for example, exists not in man alone, but in all quadrupeds and in birds; in the former it bears as a large a proportion to the rest of the brain as in man; of consequence is not likely to be the seat of the superiour intellectual principle.

The authors of the craniological or physiognomical system seemed disposed to refer frequently to comparative anatomy for the support of their doctrines; but so far as I have observed, there do not appear to be very good grounds for such a reference. If any animal be remarkable for a propensity, and exhibit a peculiarity in the form of the cranium, they connect these two facts together, and consider the peculiar part of the

cranium or of the corresponding brain to be the seat of the propensity; and this they think certain when such facts concur in regard to more than one kind of animals; and they believe that these facts tend to confirm the connexion between similar appearances and propensities in the human species.

One or two examples will be sufficient to show how far they are justified in their appeal to the anatomy of animals. The organ of *combativeness*, or courage is said to reside in the space between and behind the ears; that is, in the part which corresponds to the posterior inferiour angle of the parietal bone, behind the mastoid process: and "courageous animals have the head between and behind the ears large."* Some of them, in truth, have the head large, but not the brain. The cavity of the cranium in the *lion* and in *large dogs* is oblong in a direction from before backward; the skull is narrow at this part and the appearance spoken of does not exist in the bones. In the skulls of two lions in my possession, and various large dogs, the cranium is more narrow at this part than in the skulls of *various monkeys*, and is not materially broader than in the sheep. In birds, the cranium of an owl is broader than that of the eagle.—The great apparent breadth, in this part of the head of the lion, is produced by the enormous thickness of the temporal muscles;

* *Physiognomical System*, p. 302.

and when they are stripped off, the skull is seen to be actually narrow.

The *organ of amativeness*, which Dr. GALL formerly called organ of physical sensibility, is placed in the cerebellum, its region externally, corresponding with the lowest posterior part of the os occipitis. An examination of this region in animals, remarkable for the propensity, does not exhibit a considerable development of the part. In the monkeys generally, it is much less developed than in man; and in the baboon, the most extraordinary of all animals for the propensity,* it is in no way remarkable. Further, a comparison of the proportionate bulk of the cerebellum is still more unfavourable to this opinion; although Dr. SPURZHEIM seems to consider this as one of his strongest positions; for the cerebella, he says, are always proportioned to the propensity; they are larger in men and males, than in women and females; and, on the whole, he concludes, "that this organ and its special faculty are fairly established."† If the table of the cerebellum, before given, be noticed, it will appear that the proportion of the cerebellum is, in many animals, greater than in the monkeys, and that precisely the same proportion exists in the baboon and in the horse: animals differing widely in the degree of this propensity.

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* V. BUFFON. *Hist. Nat. des singes.*

† *Phys. System.* p. 284.

On comparing the skulls of various birds, I have not been able to verify, in a distinct manner, the supposed situation of the *organ of tune;* and the remarks relating to some other parts of the structure of the brain, and to its organs, in animals, have not appeared to be stated in such a form as to render it possible to determine their exactness.

Since it is generally admitted, that there is a vast disparity in the intellectual powers of man and brutes; and since it has been shown, that in physical organization, there is not a uniform and essential difference, or at least none proportionate to the difference of the phenomena; it will be allowed, I suppose, that the anatomy of animals cannot fairly be brought to support the doctrine that our intellectual faculties are altogether dependent on the organization of the brain. Yet I am aware it may be said there is a species of facts, presented in our daily intercourse with men, sufficient alone to invalidate any inferences drawn from brutes. Although our topic does not necessarily demand a refutation of such objections, it might appear an admission of their validity to pass them over in silence, and therefore I shall hazard some remarks on this subject.

Every one has noticed the various shapes of the head in different individuals. Differences are also seen to exist between the various races of men, and are supposed to be accompanied by corresponding differences of mind.

In order to examine this opinion in its application to different races of men, it is proper to notice the principal varieties, which distinguish the members of the human family. BLUMENBACK, the celebrated anatomist and physiologist, in his treatise, "De generis humani varietate nativa," has admitted five races or varieties of men.

First, the Caucasian,* so called, because the finest specimens of it are found in the vicinity of Mount Caucasus. This comprehends the Georgians, Circassians, Turks, Jews, Arabians, Moors, Greeks, and the European nations generally.—In this variety, the forehead is elevated, and laterally enlarged; the face small in proportion to the cranium, and the nose prominent. The skin is of a white colour.

Second, the Mongol, contains most of the Asiatics; the Calmucs, the Chinese, Japanese, Hindoos, Laplanders and other inhabitants of the hyperborean regions. The forehead is more depressed than in the former; the cheek bones are prominent and project laterally, nose broad,

* Plate 5.

and the whole head of a square form. The complexion of an olive colour.

Third, the African or Ethiopian variety, is composed of the inhabitants of that quarter of the globe, with some exceptions. The skull is compressed laterally at the fore part; the forehead consequently is narrow; it is also low and slanting. The face is long, the upper jaw prominent, the lower retreating. Skin black.

Fourth, American Indian,* contains the greater part of the inhabitants of our continent. In this race, the prominent features are high cheek bones, with the zygomatic arches laterally extended, forehead projecting in a ridge above the orbits, and flattened the rest of its extent; opening of the nostrils large, upper jaw prominent, but flattened before, orbits wide and quadrangular, vertex elevated. Skin red or copper coloured.

Fifth, Malay or Island race,† inhabit the innumerable isles in the Pacific, Southern, and Asiatic oceans. The face is long, from the extent of the upper and lower jaws; the upper is projecting, though not so much as in the African; orbits near together; forehead retreating. Colour of the skin tawny, but varying.

The characters indicated above are to be

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* Plate 6 and 7. † Plate 8.

considered as taken from strongly marked specimens; but if we compare a considerable number of individuals in either variety, it will be found that the distinguishing marks are not so striking, that the peculiar features run into each other, and that in a great number of instances, it is impossible to discriminate between the varieties.

The characters of the Asiatic of the Caucasian race pass into the Persian; the latter, of Mongol origin, into the Tartar and Chinese; these are connected with the Malay of the neighbouring islands; while the Mongol of the north of Asia run into the American variety.—The Abyssinians connect together the African and Caucasian; a portion of the Malays, as the natives of New Holland approach the African; while the inhabitants of Otaheite, Nooahevah,* and

* Nooahevah is one of a group of islands, near the Marquesas, called Washington islands. "The men of this island are remarkably handsome, of large stature, and well proportioned; they possess every variety of countenance and feature, and a great difference is observable in the colour of the skin, which, for the most part, is that of a copper colour; but some are as fair as the generality of working people, much exposed to the sun of a warm climate."—"The young girls were handsome and well formed, their skins were remarkably soft and smooth, and their complexions no darker than many brunettes in America, celebrated for beauty."—(*Capt.* PORTER'S *Journal of a cruise to the Pacific in* 1812, *etc.*—*p.* 14. *v.* 2.)

other islands, come nearer to the Caucasian.—A part of the natives of North America, varying from the common characters of their race, more resemble the Caucasian than the Mongol. Instances of such resemblance are seen among those called in the United States southern Indians, inhabiting south of the Ohio, on the eastern bank of the Mississippi; and south of the Missouri on the western.* From all these facts, it is obvious that no distinct boundary lines can be drawn between the different varieties of the

* Among the band of Osages, who visited Boston a number of years since, some of the individuals were remarkably well formed. Sketches of the heads of two of them were taken. One, a young man, six feet, six inches, in height, and well proportioned, had a light colored skin, aquiline nose, and a mild, intelligent countenance. In the other the face had an expression of acuteness and habitual reflection; the nose was aquiline, thin, and pointed; chin projecting. Neither of them could be distinguished from fine European heads, but by the colour of the skin, and the habiliments. A late traveller in their country, informs us "that the complexion of the Quapaws, like that of the Choctaws and Creeks, is dark, (as if tanned?) and destitute of any thing like the cupreous tinge. The symmetry of their features, mostly aquiline, often amounts to beauty, but they are not to be compared, in this respect, to the Osages, at least, those of them who now remain." CHARLEVOIX says, "the Arkansas are reckoned to be the tallest and best shaped of all the savages of this continent, and they are called by way of distinction, *the fine men.*"—NUTTALL'S *travels into the Arkansa Territory, in* 1819, *p.* 83.

species, since they are on each side passing by imperceptible grades into each other.

All the variations in the form and colour of man are to be ascribed to the gradual operation of moral and physical causes, acting for a great length of time. These causes are, difference of climate, food, habits, and the propensity, modified by these causes, which all animals have to vary the form, size, colour, and disposition of their offspring. The opinion that they are to be explained by supposing half a dozen different origins, is scarcely maintained by any one; and affords no better solution of the cause of all the varieties, than the belief that all have sprung from one common stock.

The various modes of education, and other peculiarities in the condition of the different races render it difficult to judge how far their intellectual powers are modified by the differences in the shape of the cranium.

The Mongolian race is perhaps as susceptible of improvement as the Caucasian. The Chinese, Japanese, and other nations are acquainted with many arts not known in Europe: and it seems fair to believe that if their prejudices were broken down by intercourse with foreign nations, and their minds enlarged by the introduction of Christianity, they might rival the Europeans in literary and scientific acquirements.

The North American Indians are at last beginning to submit to the discipline of civilized life. The slowness with which they have done this, might be supposed to arise from incapacity of attaining the sciences of Europe: but this would be a mistake. The difficulty in civilizing these inhabitants of the forest has been dependent on the injudicious and inadequate efforts made to reclaim them. Habits of living are so early formed that a boy educated to the age of ten years in the European manner, would not by any subsequent treatment make a figure as an Indian warrior: and the young Indian, allowed to pass the ten first years with his nation, is a savage and will continue so the rest of his life. It is vain to put him in a school or college subsequently to that period; he will, after a short residence almost certainly make his escape to his native forests and his favourite rivers.* There is but

* At an early period of the existence of Harvard University our pious ancestors placed there a number of young Indians. These, after a short term of study, uniformly disappeared, and I believe the name of *Caleb Chees-chaumuck* stands on the college catalogue, a solitary instance of a native regularly graduated. It is well known however, that among our aboriginals, converted to Christianity, there were a number who served as devout and useful assistants in the instruction of their countrymen. A recent example of the difficulty of reducing the young savage to the habits of civilized life is well known in this vicinity. The government of the United States, after the late Indian war placed the son of the prophet

one way in which we can expect these nations to become broken to the habits of civilization. They must be taken from the cradle and placed in schools, before they have acquired the habits and inclinations of a wandering life: and the rest of their education must be conducted like that of a European or an inhabitant of the United States. This system is now happily reduced to practice by the missionaries among the Chickasaws, Choctaws, Creeks, Cherokees, and Arkansas; and among the Hindoos of India, the Negroes of Africa and the Malays in many of the South sea islands. If any persons are disposed lightly to estimate or to deride the missionary labours, they must do so from a very partial view of the great plan of operations now executing in every part of the globe, and slowly, though surely producing the greatest changes, especially among the Indians of this country. Those who are blind to the importance of diffusing the Christian religion among our aborigines, will be ready, I presume, to admit the necessity of making efforts to rescue this interesting people from the misery and destruction, of which, we and our fathers have been the cause. The administration of this country is, fortunate-

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Tecumseh at the West Point establishment of cadets. The young man conformed at first with apparent ease to the strict discipline of the institution; but on their visit to this place in 1821, he availed himself of an opportunity to quit them and has not I believe since rejoined the corps.

ly, favourable to the proper system, and if supported by the opinion of the enlightened part of the community will, through the missionaries, as well as by their own influence certainly effect a great change in the condition of the Indians. Instead of insults and encroachments on the one part, drunkenness and murders on the other, we may hope soon to see them composed into regular societies, governed by appropriate laws, and, adding a moral force to their physical strength, they may become incorporated with and form a valuable accession to our country. Already the arts are beginning to flourish among them. The CHEROKEES have adopted a written constitution: they have a number of large and well regulated schools; and the CHOCTAWS have, of themselves, set aside a considerable sum, from the annuity granted them by the government of this country, in order to establish and support their schools. Many of these people have undertaken the more necessary trades: manufactures are beginning to appear among them, and their country is interspersed with a multitude of small, yet well cultivated farms.*

* The secretary at war in his report states, That there are now in the Indian territories, supported by the government of the United States, eleven principal schools and three subordinate ones, and that three are in a state of preparation: that the number of scholars at the last return amounted to five hundred and eight.

The facts hitherto reported as to the capacity of the Indians for improvement are favourable:

It may be affirmed, he says, that all the tribes within our settlements and near our borders are even solicitous for the education of their children.—The reports of the teachers are almost uniformly favourable as to the capacity and docility of their youths. Their progress appears to be quite equal to that of white children of the same age; and they appear to be equally susceptible of acquiring habits of industry. At some of the establishments, a considerable portion of the supplies are raised by the labour of the scholars and teachers.

The Cherokee nation, which has made the greatest progress in education, has also made the greatest progress in government. Their zeal for improvement is further evinced by the liberal provision they have made for a school fund, for which the last treaty with them stipulates, and the fact that there are now established in the nation six schools, two of which are on the Lancasterian system, containing in the aggregate two hundred and fifty scholars. (*Report to Congress on Indian civilization, February* 8, 1822. *By Secretary* CALHOUN.)

The Creeks are not willing to admit the establishment of schools by the whites through jealousy of them; but they are not backward in introducing improvements of their own.—"The more reflecting part of the Creeks," says an English missionary, "think much, but say little of the change which is taking place in their condition. They see plainly, that with respect to their future destiny, it is a question of civilization or extinction; and a question, the decision of which cannot be long postponed. They are therefore becoming very solicitous for the establishment of schools, and the introduction of the various arts from which the whites derive their superiority. In some of these, they have already made considerable progress; and the nation at this time exhibits the spectacle of society in several of its early stages. The hun-

but the experiment will not have been fairly tried, until they have received the education of whites, have come forward to perform professional and political duties, and have themselves had an opportunity of answering the question, whether nature has made them inferiour to the Caucasian race.

The Africans in their native land are generally subjected to political institutions, domestic habits and the action of a climate, calculated to reduce them low in the scale of men. In the very few native Africans seen in this part of the United States, the countenance is often contracted, the body ill-formed, and the mental faculties of a low order. In the second generation, their appearance alters for the better, the features expand, and assume a milder character; the body becomes more upright. In one of the New-England states, where slavery was retained, in a mitigated form, longer than in the rest, it has been distinctly noticed, that the children of Afri-

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ter, who still spends much of his time in his favourite pursuit, is the possessor of perhaps several hundred head of cattle, and if the warrior do not literally turn his tomahawk and scalping knife into pruning-hooks, he is satisfied to regard them as mere ornaments of dress, until war and ambition shall again call him into the field; and is ambitious to obtain distinction in agricultural pursuits. I saw several neat and flourishing little farms, as I passed through the nation."—(*London Missionary Register, for November*, 1821.)

cans, born in this country, and brought up with those of the whites, as occasionally happened in large country estates, were as intelligent, as gay, as ready to imbibe the rudiments of learning as the whites; and if their education had kept pace with that of the latter, they might generally have continued on the same level through life. An experiment in regard to this people is now making in St. Domingo on a large scale. At present, it promises a successful result; as the policy adopted since the establishment of the Haytian republic appears to be unexceptionable, and stands on as respectable a footing as that of the nations of Europe. If they can maintain their independence long enough for one generation to rise under the new order of affairs, the reputation and the future fate of the African race will be settled in the opinion of the civilized world.*

Some nations have the practice of altering the shape of the head by artificial means. Very remarkable changes from this cause are occasionally seen. Yet it does not appear that the

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* L'inegalité d'esprit qu'on remarque entre les hommes dépend donc et du gouvernement sous lequel ils vivent et du siècle, plus ou moins heureux où ils nâissent, et de l'éducation meilleure ou moins bonne qu'ils reçoivent, et du désir plus ou moins vif qu'ils ont de se distinguer et enfin des idées plus ou moins grands ou fécondes, dont ils font l'objet de leurs méditations.—*Helvetius. De l'Esprit. Tom.* 1. *p.* 618.

mental powers undergo a correspondent alteration. The Caribs of the West Indies were scarcely less peculiar for their gigantic stature and great strength, than for the extraordinary depression of the forehead: and it is no where I believe stated that they were inferiour in mental ability to other Indians; but as they were more powerful, we have reason to suppose they were more intelligent. CHARLEVOIX long since described the custom of the North American Indians of compressing the head and giving it a rounded or flattened form, according to the fashionable idea of beauty, in different nations. But we have more direct knowledge on this subject from authorities of the present day and our own experience. Captains LEWIS and CLARK, who were sent by the government of the United States to explore the Missouri and the Columbia rivers, lived a considerable time among the nations remarkable for this practice, and have given us a very satisfactory account of their character and habits. All the Indians situated between the Rocky Mountains and the Pacific Ocean, with the exception of the Snake nation, are accustomed to flatten their foreheads by compression made at an early period of life.* This fashion begins to show itself

* See LEWIS and CLARK's description. The machines used for producing the compression have been obtained from

on the westesn side of the mountains, becomes more predominant as we approach the sea-coast, and probably extends northward along the coast to a high latitude. The degree of distortion varies. In the two skulls we have represented, one, plate sixth, has only a slight circular depression, extending over the crown of the head, behind the coronal suture and corresponding with this in its direction. The other, taken from the same place, on the banks of the Columbia, is greatly distorted.* From its large dimensions, it seems to have belonged to a man of ample frame: and as our navigators say that the chiefs are always the most remarkable for the degree of this deformity, we may consider it probable that this was the skull of a person of high standing in his nation.—These people, denominated *flat heads*, are described by LEWIS and CLARK, as "inquisitive and loquacious, with understandings by no means deficient in acuteness, and with very retentive memories."†—"Every thing they see excites their attention and inquiries; but having been accustomed to the whites, nothing appeared to give them more astonishment than the air gun. To all our in-

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the north-west coast, by colonel PERKINS of this place, and are in the hands of Dr. CHANNING.

* See description accompanying the plate.

† LEWIS and CLARK's Expedition. Vol. 2. p. 136.

quiries they answered with great intelligence, and the conversation rarely slackened, since there is a constant discussion of the events and trade and politics in the little but active circle of the Killamucks, Clatsops, Cathlamahs, Wahkiacums, and Chinnooks."* They are singular among savages for their kind treatment of old people and of their women. The latter are more on a level with the men, are allowed to give their opinions freely, and even sometimes assume an air of authority. These people are acute and dexterous in their bargains, equalling in finesse the most experienced European traders: they are perfectly acquainted with the use of fire arms, yet are friendly, peaceable, and, although in the habits of intercourse with the whites for the last thirty years, have never adopted the use of ardent spirits.—Most of the Indian nations, visited by these travellers, were either mischievous and dangerous, or weak and fearful; the flat heads of the Columbia met them with boldness and associated with them freely. One of the natives of this coast I have often seen, and shall ask leave to give some account of him. This young man was well known

* Mr. KEITH, the gentleman who procured the two skulls engraved, lives in the settlement at the mouth of the Columbia, and in his letter on the subject, among other things he informs us, that the change in the form of the head, "appears no wise to affect their intellectual or corporeal faculties."

to a great number of persons in Boston by the remarkable appearance of his head. His forehead was flat; at the posterior part of the crown, the cranium rose to an extraordinary height in the form of a sugar loaf; the elevation appeared so considerable to those who knew him that I should not venture to state its estimated measurement. This boy, when ten years old, was brought from the Port Bucarely, in one of the Queen Charlotte islands, by a gentleman of this place,* who purchased him for a trifle to prevent his being put to death as a prisoner, taken in war with a neighbouring nation. He lived here many years as a servant; was found to be in no respect wanting in understanding; his apprehension was quick, and his capacity for retaining what he learnt, quite equal to that of other boys of his age. To use the words of a gentleman of the family in which he lived, "he was remarkably intelligent and sagacious, but inclined to mischief." He was not easy to control, was therefore taken a voyage, at the age of eighteen; and having an opportunity, he quitted the ship at some of the West India islands, and has not since been heard of.—The existence of a single case like this, shows what great alterations of form the brain may undergo without any change in the amount of intellectual facul-

* E. Dorr, Esq.

ties, and without any obvious defect or diminution of any one mental quality.

The peculiarities of the female mind in every nation on the globe are not accompanied with a visible difference in cerebral organization. The most acute anatomists have sought in vain for characteristic distinctions in the brain of females; but neither in its general form, its size, or the proportion of its parts have any such distinctions been ascertained to exist. The face in this sex is smaller, the thickness of bone usually less than in males, so that although the head is not so large, the brain is of equal size and weight.*

Common observation shows that the degree of intellect is not proportioned in different individuals to the size of the head; since we often see stupid people with large heads and sensible men with the head small. Opportunities have been afforded me of examining the brain in a considable number of persons of high standing, in our country and such as were remarkable for talents; in some instances it has appeared that a large brain had been connected with superiour mental

* Quemodmodum verum caput virile in universum majus est femineo, ita et cerebrum virile in universum majus, et ideo etiam ponderosius *videtur* femineo. Verum tamen, quod cavum capitis, cerebrum continens ratione faciei habita, in femina majus est quam in viro hoc discrimen solvitur. (SOEMMERRING *De Corp. hum. Fabr.* Tom. 4, p. 39.) Also, GORDON's *Anat.* p. 169.)

powers, in about as great number, the reverse: and one individual, most distinguished for the variety and extent of native talent had an uncommonly small brain.*

If we were willing to admit that the form or size of the head in different individuals, races, and sexes has a direct and important influence on the mental qualities, it would not necessarily follow that the difference in the form of the head and brain in brutes, afforded an adequate explanation of the inferiority of their intellect. The difference in the faculties of human individuals or nations is in degree only; that between man and brutes is immeasurable: in all the varieties of men we find the same number of faculties and propensities, but in brutes many of those belonging to mankind are wholly deficient.

The only remaining point of comparison between the brain of man and animals is their chemical composition. Some persons might possibly believe that although there be no difference of form or bulk sufficient to explain the disparity of function, yet there may be a difference in the chemical constituents worthy of consideration. According to a late analysis of Vauquelin, the most remarkable parts of the human brain

* Aristotle gives a decided preference to a *small* head, διὰ γὰρ τοῦτο καὶ μικροκεφάλους, καὶ αὐλῶν οἱ τοιοῦτοι μᾶλλον τῶν μεγαλωκεφάλων φρονιμώτεροι. *Aristot. Problem. Sect.* 30

are composed of a reddish and whitish fatty matter; albumen; osmazome; phosphorus; acids; salts, and sulphur, in the following proportions:

1. White fatty matter . . .	4 : 53
2. Reddish fatty matter . .	0 : 70
3. Albumen	7
4. Osmazome	1 : 12
5. Phosphorus	1 : 50
6. Acids, salts, and sulphur .	5 : 15
7. Water	80 : 00
	100 : 00

"The cerebellum of man and the brain of herbaceous animals being examined in the same manner, and with the same precautions gave similar results."* The experiments of other chemists have, so far as I am informed, presented the same phenomena, with re-agents, in the cerebrum of brutes as in that of man; and we have reason to believe that their similarity in this respect is greater than in any other of the particulars we have formerly spoken of.†

No one will suspect me of intending to say that the condition of the brain has not an influence on the mental powers.—The mind, it has been said, employs the brain, as the material instrument of

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*Vauquelin, *Annales de Chimie.* V. 80. p. 37.

†V. Klaproth, *Dict. de Chimie. Trad. Franc. Art. Cerveau.*

its operations, and these may of course be more or less perfect according to the perfection of the instrument: but in what this material perfection consists, or to what extent it may influence the intellectual faculties, we are wholly unable to say. Our powers fail in the attempt to estimate the connexion between the visible matter and the invisible mind; there is nothing like nor analogous to it in the world which surrounds us; no wonder is it then that all metaphysicians and physiologists from the time of PLATO and ARISTOTLE have not thrown a ray of light on this part of our economy, and that it remains veiled in the same impenetrable and mysterious obscurity from their day to the present.

GENTLEMEN,—The views we have taken, of various points of comparative structure, must, I think, satisfy you that there is not such a peculiarity in the great sensorial organ in man, as to elevate him as much in physical as in moral superiority. Man, gifted with the use of language, improvable by education, transmitting improvements to his posterity, and elevating his thoughts to an invisible world—while he is allied to animals in his material organization, is connected by mind with the spiritual.

We must then, my friends and fellow-labourers, throw aside the discouraging and degrading notion

that we form a part of the same chain which connects different classes of the brute creation—a thought that binds us to the earth and weighs down our most animating hopes. In vain would a sense of moral duty or the consciousness of utility be resorted to, as the support of the physician, through disgust, overwhelming fatigue, and the menace of disease and death; he must look higher than the material or the moral world for his reward; and he who cannot confidently turn *thither* his expectations, though he may be esteemed skilful, popular, and fortunate, must still experience the depression of heart, arising from the sentiment that the rewards of his fellow men bear no proportion to his efforts and his responsibility.

Having concluded this imperfect view of the sensorial apparatus, and adverted to the physiological inductions most obviously arising from it, we take leave of the subject with a reflection likely to present itself to every mind. Looking back through the long range of beings, whose structure we have, in part, delineated; when we consider the wonderful adaptation of their structure to the habits, the wants, the abodes of each animal; when we notice the gradual change of organization from the higher to the lower beings, the regular diminution and disappearance

of parts; when we observe that in creatures, whose general appearance, and structure, and habits, are widely dissimilar, traces of the same organs, fitted for the same functions, are constantly re-appearing:—the most insensible must recognise the work of ONE HAND, the blindest must see the traces of a single omnipotent, omniscient power, ever varying the features of his works, yet always stamping them with the impression of a common, almighty origin.

APPENDIX.

A.

THE anniversary meeting of the society has of late years been attended by the Governour of the commonwealth, who is a fellow of the society, together with his Council.

Among those, not of the medical profession, who have contributed to improve the state of medical science, in this country, I take pleasure in recording the name of an individual, WARD NICHOLAS BOYLSTON, Esq. To this gentleman we owe,

First.—A valuable collection of healthy and morbid anatomical preparations, constituting the museum of the celebrated Dr. NICHOLS, and presented by his son, Sir JOHN NICHOLS, through the suggestion of Mr. BOYLSTON, to Harvard university.

Second.—A library of valuable and costly medical books, of about a thousand volumes, also presented to the university.

Third.—The establishment of prize questions, on medical subjects. For the best dissertations

on subjects given out, two or more prizes, of considerable amount, are annually awarded.

In addition to these, as well as other liberalities to the university, Mr. Boylston has established a fund to be devoted to the erecting and maintaining a new edifice in the university, for the anatomical lectures, museum, and library.

The Massachusetts Medical Society have so highly esteemed the benefits done the profession by this gentleman, as to pass a permanent vote of invitation to the anniversary of the society—a mark of respect not bestowed on any other individual.

The following distinguished fellows and officers of the society, have lately died.

B.

Thomas Kittredge, M. D. was distinguished as a practitioner of surgery and medicine through the state of Massachusetts. He was born at Andover, in July, 1746; received his academic education at Dummer academy, in Byfield, and studied his profession with Dr. Sawyer, a distinguished physician in Newburyport. In 1768, he returned to Andover, and began the practice of medicine and surgery. At the revolution, he was appointed a surgeon in the army, and being stationed at Cambridge, had an opportunity of being present at the action of the 17th June, 1775.

Dr. KITTREDGE sustained many municipal and political offices, especially he was often a member of the legislature of the commonwealth, and was there useful to the Medical Society, by exerting his extensive influence in its favour.

His practice as a physician was very large; but he was most distinguished as an operating surgeon, for a great number of years. In the practice of medicine he was thought remarkable for his readiness in discriminating diseases.

He began to be affected by angina pectoris in the year 1810, and died of this disease in October, 1818, after an illness of three hours.

The family of which he was a member, has become so distinguished for surgical skill in New England, that in many places the name alone is a passport to practice; and the number of practitioners of this name is very considerable. This is to be attributed, not only to the well-earned reputation of Dr. KITTREDGE, but to that of his father, who had also a high reputation in surgery; and it is not improbable that his grandfather and great-grandfather, the latter of whom came to this country from Germany at an early period, and settled at Tewksbury, were eminent in the same line.

C.

JOHN JEFFRIES, M. D. was born at Boston, in February, 1744, graduated at the neighbouring

university of Cambridge, in 1763, and afterwards studied medicine as a pupil of the distinguished Dr. Lloyd. In 1766, he went to England, and completed his eduation under the instructions of the distinguished men of the time. Having taken the degree of doctor of physick at the university of Aberdeen, in 1769, he returned to Boston, and established himself as a practitioner of medicine. In 1771, admiral Montague appointed him assistant surgeon to a ship of the line, in which post he continued until 1774; and when hostilities began between the Americans and British, in 1775, he was employed by the British commander, and had an opportunity of relieving numbers of both parties, wounded in the bloody contest of Bunker Hill. When the British forces quitted Boston, he accompanied them to Halifax, and received the appointment of surgeon general in Nova Scotia, and purveyor general to the hospitals, and afterwards that of apothecary general. In this situation he improved the opportunities, which presented, of alleviating the distresses of his countrymen, who were prisoners of war. In 1779, he went to England, and, having passed examination at surgeon's hall, with great credit, was appointed to the office of surgeon major in America, and, returning to the United States, remained in service until the latter part of 1780, when he was called to England by domestic occurrences.—

Having obtained the friendship of two eminent physicians in London, Drs. TURTON and WARREN, he succeeded in establishing himself as a physician in that city. While thus engaged, he undertook two aerial expeditions, the last of which, when he crossed the British channel with Blanchard, is well known to the world, as the most hazardous exploit of the kind that has been performed. Dr. JEFFRIES continued his practice in London until 1790, when he was induced to return to Boston, and soon obtained a most extensive and respectable practice. In this he continued until September, 1819, when he was attacked by an inflammation of the bowels, originating in a hernia, which proved fatal in a few days.

Dr. JEFFRIES was remarkable for his love of science and literature. He read much, and was therefore led to collect one of the most valuable private libraries in the country. His professional business was not confined to medicine; he was well versed in the principles and practice of surgery. But especially he was distinguished by an ardent love for anatomy, and this favourite pursuit he continued to the last years of life.

D.

PETER BRYANT, M. D. was a practitioner at Cummington. This gentleman was esteemed in the part of the country where he lived, for

his skill in the surgical art. He become known to the physicians in the metropolis by his frequent appearance in the publick legislative body; where he was always active in promoting improvement in the sciences, and especially that of medicine. Dr. Bryant was as remarkable for a modest and reserved demeanour, as for his acuteness, love of study, and profound knowledge of his profession. He was twice appointed to deliver the annual dissertation of this society, and when he was preparing to visit Boston, to perform this duty, in June, 1819, he was attacked with the disease, to which he ultimately fell a lingering victim.

E.

Josiah Bartlett, M. D. was born at Charlestown, in the year 1759, and having received his medical education from Dr. Isaac Foster, a very respectable physician of the time, he entered the American army as surgeon's mate, on its formation at Cambridge, on the 20th April, 1775, the day following the battle of Lexington, and rising through various grades he continued in the public service until the year 1780, when he resigned his commission and went two voyages as surgeon of ships of war. About the close of the war he settled in his native town, and became a member of the honourable fraternity of masons, among whom he was very distinguished,

and occupied all the posts of honour to that of grand-master, and especially was conspicuous for the number of occasional and appropriate addresses which he delivered in that society. Dr. Bartlett, having had an opportunity of attending only a single course of lectures belonging to medical education, in the early part of his life, namely, a course of lectures on anatomy, delivered in Boston, in 1780, by Dr. Warren, resolved, long after his establishment in business, to avail himself of advantages which the improved state of the country afforded, and notwithstanding his extensive practice, attended a complete course of medical lectures at Cambridge in 1790 : and in 1791 became bachelor of medicine, and in 1801 doctor of medicine. In 1789 he was admitted to be a member of the Massachusetts Medical Society, soon after became recording secretary of that highly respectable body, and continued in office in various situations until his death; and perhaps no man contributed more time and active exertion to improve the state of the society, and through it the interests of medical literature. He delivered two discourses of a medical nature ;—one before the Middlesex medical association, the other before the Massachusetts Medical Society; the latter of which is well known as affording a very interesting historical sketch of medical characters in this part of the country, from its settlement. He also published

various papers on medical subjects, in the communications of the Medical Society, and in the New England Medical Journal.—Although engaged in a most extensive practice, he found time to employ a part of his activity in civil offices, and was at various times elected representative, senator, and counsellor, in the state government.

Dr. Bartlett's character was remarkable for industry, activity, and intelligence. He never declined any duty which was assigned him, and always executed it speedily and thoroughly; and was of course constantly resorted to for difficult services. Perhaps no individual in this vicinity delivered so great a number of public orations, medical, political, and literary. He possessed a physical constitution which promised a long as well as active life; but his spirits being broken by unfortunate occurrences, his health in consequence became impaired two years before his death, his activity was paralysed, his desire of life was extinguished, and at length on the third day of March, 1820, he was struck with an apoplexy, which in two days after terminated his existence.

F.

Lemuel Hayward, M. D. was born at Braintree, in this state, and received his degree at Cambridge, in 1768. In about a year after he came to Boston, and placed himself as a medical

pupil under the direction of Dr. Joseph Warren, who afterwards fell at the battle of Bunker Hill. He had for his fellow students three gentlemen, all distinguished for their patriotism and public services, Dr. Samuel Adams, Dr. Eustis, and Dr. Townsend. Having completed the usual term of study, he established himself, by the advice of his preceptor, at Jamaica Plains, near Boston, and soon acquired a lucrative and respectable practice. When the revolutionary war broke out, he was, in June, 1775, appointed a "surgeon in the general hospital, in the continental army," and served in that post till the British evacuated Boston, and the American troops marched to the middle states. In 1776, he began the practice of inoculation for the small pox, in connexion with the venerable Dr. Isaac Rand, of Charlestown, the first of the name, and continued it for several years successively, in company with Dr. Davies, of Roxbury, Dr. Aspinwall, of Brookline, and Dr. John Warren, of Boston. In 1783, he removed to the capital, without at first intending to engage in medical practice; but he was afterwards induced to resume his business, and from this time his reputation increased rapidly, and his professional occupations soon became very considerable, and continued so until the year 1798. The appearance of the yellow fever in that year induced him to purchase a retreat for his family in the country;

and his property being now ample, and his health impaired by a severe asthmatic complaint, he afterwards spent several weeks in the country, during the summer season.

Dr. HAYWARD was admitted to the Massachusetts Medical Society in the year 1784; and was chosen corresponding member of the London Medical Society, in 1791. He was also a member of the Bristol Medical Society in England; and of the Massachusetts Agricultural and Humane Societies. For many years he was a counsellor in the Massachusetts Medical Society, and also for a long time filled the responsible and delicate offices of chairman of the censors, and of the committee of Boylston Prize Questions.

In the early part of his life his professional reading was extensive; but in his latter years he preferred reading history, theology, and works of fancy. Though he read and thought much, and often committed his reflections and observations to writing, he was wholly unambitious of literary and professional honours, and never could be brought to overcome the reluctance he felt to publishing. He was a firm believer in the truths of Christianity, and become a public professor of it at the early age of nineteen.

In the social and domestic relations of life he appeared to the greatest advantage; for he was cheerful, kind, hospitable, and full of agreeable and instructive conversation. As a physician, he

was excellent for his power of discriminating diseases, and especially for his skill in varying the remedy according to the stage of disease. His interest in his patients was very strong, but his sensibility did not brook any neglect or want of confidence.

The asthmatic affection, which had troubled him through a considerable part of his life, disappeared some years before his last illness; instead of it, he exhibited symptoms of an organic disease of the heart. Probably this derangement disposed him to the complaint of which he died. In the early part of March he was seized with inflammation of the lungs, which, after more than once assuming a flattering aspect, terminated fatally on the 20th March, 1821.

G.

Sir EVERARD HOME's Croonian lecture. The part which treats on the brain and nerves, showing that the materials of which they are composed exist in the blood.—Read to the Royal Society, December 7, 1820.

The retina being examined by Mr. BAUER, in the microscope, he found the optic nerve to consist of many bundles of extremely delicate fibres formed of minute globules connected together by a gelatinous substance, which readily dissolves in water. The dimensions of the globules, measured on the micrometer, explained in the preceding lectures, are from $\frac{1}{2800}$ to $\frac{1}{4000}$ parts of an

inch, mixed with very few of $\frac{1}{2000}$ parts, the size of the red globules deprived of their colouring matter.

The retina appeared as a continuation of the bundles composing the optic nerve, and consists entirely of the same sized globules connected into fibres, and forming bundles, which go off distinctly from the end of the nerve, like rays: towards the circumference they almost disappear, and end in smooth membrane.

The whole retina is interwoven with innumerable blood vessels, both arteries and veins; the gelatinous substance that holds the globules together, dissolves in water very readily; so that if the parts are soaked in water for three or four days with a portion of the optic nerve, they become a mass of globules, and the blood vessels, when separated, form a beautiful delicate net work, their branches anastomosing freely with one another.

By the discovery of this transparent substance, we become acquainted with the nature of the medullary structure of the nerves; and can form some idea of their action, which till now, I confess myself to have been totally unacquainted with. The nerves, as well as the retina, are composed of this newly discovered transparent substance, which is very elastic, and soluble in water, and globules of $\frac{1}{2800}$ and $\frac{1}{4000}$ parts of an

inch in diameter. Its transparency and solubility account for its having remained concealed; and were it not coagulable, in which state it becomes opaque, its existence might even now be considered as equivocal.

Before I say more of this transparent jelly, I will state Mr. BAUER's observations on the structure of the brain, of which it makes an essential part. If the mass of the brain is kept in water for forty-eight hours, and a thin slice is cut from the medullary part of the cerebrum, and laid upon a glass plate previously wetted with water, and a drop of water is allowed to fall upon the slice, holding the glass a little obliquely, so that the water must run across the surface of the glass, the force with which it moves is sufficient to break down the medullary substance of the brain, so as to bring distinctly into view innumerable loose globules, many fragments of fibres of single rows of globules, and bundles of fibres, some of them of considerable length.

If the substance of the brain is laid upon a piece of dry glass, and the separation of its parts attempted by instruments, it is impossible to effect it, as the viscous mucus adheres strongly to the glass, and the substance would be indistinctly daubed on the glass, in the manner of a pigment, a state in which the globules are not discernible.

It is impossible to distinguish the fibres composed of globules, in an opaque state of the substance; for although in the section of any part of the brain, by means of a very strong magnifying lens, lines are discernible, these lines are produced by the light and shade on the substance, and only denote the bundles of fibres of which the brain is composed, but not the simple globular fibres.

The gelatinous mucus seems to dissolve readily, and mix with the water; and being perfectly colourless and transparent, is entirely invisible while the substance of the brain is fresh, or whilst it is immersed in water; but if the water is left to evaporate, and the substance gets dry, the mucus collects round the loose globules and fibres in considerable quantity, as forms irregular flakes or splotches upon the glass, perfectly transparent, and of a yellowish tinge.

If a portion is cut off from the brain in a fresh state, before it has been put in water, and laid upon a dry glass plate, and covered by a cup, so as to prevent evaporation, a perfectly colourless aqueous fluid is exuded which evaporates on exposure to air and hardly leaves any mark upon the glass.

The cortical substance of the cerebrum contains also a fluid resembling the serum of the

blood; it has a yellower tint than the fluids in the medullary substance, or any other part of the brain; and, when dry, it assumes the glassy appearance, and forms the cracks that the serum does when dried on the glass.

The above are all the visible materials that can be distinguished in the different parts of the human brain by means of the microscope; and making allowances for slight modifications, are the same in the different parts of the organ.

The globules are from $\frac{1}{2400}$ to $\frac{1}{4000}$ of an inch in diameter; but in general or predominant size is $\frac{1}{3200}$. They are semi-transparent, and of a white colour, arranged into fibres of single globules, and seem to be held together by the viscid mucus. The fibres form bundles connected in the same way.

The principal difference in the appearance of the different parts of the brain, consists in the proportions the quantity of mucus and fluids bear to the quantity of globular tissue in the same part, and in some respects in the size of the globules; as for instance, the cortical substance of the cerebrum and cerebellum, (which are in all respects alike) consists chiefly of globules from $\frac{1}{3200}$ to $\frac{1}{4000}$ of an inch in diameter; and the smaller globules prevail. The single globular fibres are not so readily distinguished in the other parts of the brain; the gelatinous mucus and

fluid resembling serum are very abundant. The finest and most delicate branches of the arteries and veins are only found in the cortical substance.

The medullary substance of the cerebrum and cerebellum differs from the above in the large globules prevailing ; the mucus being more tenacious and less in quantity in proportion to the globular tissue, and the single globular fibres being more distinct, and the arterial and venal branches being larger.

The crura cerebri and cerebelli resemble in general the medullary substance, only that the mucus and fluids are more abundant; and there appears a greater proportion of mucus and globules; the blood vessels are larger than in the medullary substance.

The medulla oblongata, the corpora pyramidalia and olivaria have nearly the same structure as the medullary substance ; the single globular fibres, and their bundles, are composed of the larger globules ; the mucus, however, is very abundant, and is sooner dissolved in water than the mucus in any other part of the brain.

The pons varolii is principally composed of globules $\frac{1}{3200}$ of an inch ; the fibres not quite so distinct as in the medulla oblongata ; the mucus very abundant. The medulla spinalis has the globules of $\frac{1}{2400}$ to $\frac{1}{3200}$ of an inch predominant ; the mucus and fluid less tenacious, but in greater quantity than in any part of the brain; for

this reason, the single globular fibres are not so readily discovered; for if the part is not sufficiently soaked in water, they cannot be separated; and if macerated too much, the whole is dissolved into a mass, like a cream. The corpus callosum resembles the medulla spinalis, but contains a greater quantity of globules $\frac{1}{2400}$ of an inch than any other part of the brain; the quantity of mucus and fluid are at least equal to the globular tissue.

Every part of the substance of the brain is pervaded by innumerable blood vessels, which are of considerable size towards the centre, but branch out to an extreme of minuteness, less than the half diameter of a red globule with its colouring matter; and even when of that size the fluid they carry is red.

These arteries in the brain never anastomose, as in the retina; their branches are accompanied by veins of still less diameter, having valves. The valves are at very short distances, particularly near their extremities; and when the brain is fresh, these veins contain a red fluid.

The circumstances noticed by Mr. Bauer, namely, the cortical substance of the cerebrum and cerebellum being made up of the small globules; containing the gelatinous fluid soluble in water in great abundance; and having branches more minute than the other arteries of the brain;

also the corresponding veins having valves similar to those found in absorbent vessels, and their canals carrying red fluid,—throw considerable light upon the functions of the brain, and show that the cortical substance is one of the most essential parts of this organ, although the pons varolii, as the commune vinculum between the different portions of this complicated structure, may be most essential to life.

That the cortical part of the brain is the seat of memory is an opinion I have long entertained, from finding that any continued undue pressure upon the upper anterior part of the brain entirely destroys memory, and a less degree materially diminishes it. Pressure upon the duramater, where the skull has been trepanned, puts a temporary stop to all sense, which is restored the moment that pressure is removed, and the organ appears to receive no injury from repeated experiments of this kind having been made. In hydrocephalus, when the fluid is in large quantities, and there only remain the cortical part of the brain and the pons varolii connecting it to the cerebellum, all the functions go on, and the memory can retain passages of poetry, so as to say them by heart; but a violent shake of the head produces instant insensibility. Pressure in a slight degree upon the sinciput, produced in one case complete derangement, with violent excesses of the passion of lust, both of

which went off upon removing, by the crown of the trepan, the depressed bone.

The veins being so minute, and being supplied with valves, explains the circumstance of the lymphatics never having been met with in this organ; these veins performing that office, carrying the absorbed matter into the superiour longitudinal sinus, which appears more a reservoir than a vein; for the fluid that passes through it is not simply circulating blood; it contains the colouring matter in a decomposed state as black as ink, a change we shall find it undergoes in the spleen after death.

The superiour longitudinal sinus may be considered as the common receptacle of the absorbent veins of the pia mater from its triangular form, it always remains full. The aqueous liquid, by which the ventricles are filled, varying in quantity, answers the purpose of equalizing internal pressure.

H.

Account of the Crania of some of the Aborigines of the United States.

The intimate connexion between the form of the cranium and of the brain has led me to the examination of crania of various individuals and races; the result of the examinations of such as are peculiar, especially those of our own country, I shall relate here.

The crania, represented in plates sixth and seventh were those of Indians of Columbia river. They were brought here by the direction of Colonel T.H. Perkins of Boston, a gentleman very distinguished for promoting scientific and patriotic objects; by him they were given to my friend and colleague Dr. Channing, to whom I am indebted for this opportunity of representing them. Since these were engraved, a number of others have been received, one of which is more flattened than the one shown here and equals in this deformity the Carib skull in the collection of Mr. Cline.

The specimen in plate sixth* may be considered a well characterized cranium of the Indians west of the Rocky Mountains, when in its natural state. There is, behind the coronal suture, a depression deep and extensive, of a circular form, running parallel to the suture. That this is the effect of pressure I would not venture to assert, as I have noticed the same depression, nearly in the same degree, in the skull of a white American; and those who have been in the habit of examining crania, well know that the transverse depression behind the coronal suture is sometimes considerable. In other respects there is no distortion from the natural state.—The forehead is more narrow than in any skull in my possession, except the African, and is much depressed.

* The Caucasian head, plate fifth, is introduced as a standard for comparison.

The orbits are of great size and of a quadrangular form, the space between them narrow, the superciliary ridges depressed. The ossa nasi narrow and short, yet less so than in the African. The opening of the nostrils ample. The malar bones project considerably beyond the upper edge of the orbit and are enormously spread in a lateral direction. The upper jaw is more prominent than in the Caucasian, less than in the African head, and the alveolar edge flattened in front. Viewed on the vertex, the temporal fossæ are seen to be deep and the zygomatic arches to project widely from the side of the head, exceeding greatly in this, any skull I have examined. The posterior part of the vertex is prominent. The palatine fossæ are spacious, principally from the breadth of the horizontal plate of the os palati, which is, from before backward, nearly double that in the European. The foramen magnum, the posterior openings of the nasal fossæ, and the foramina in the base, are none of them remarkably large. The processes are not strongly pronounced: a fact leading us to suppose the head to have been that of a female. The capacity of the cranium is obviously small: the area of the face great, especially towards its sides. The teeth are worn smooth, though they indicate the subject to have been young.

Plate seventh, represents the skull of a Flat head Indian, distorted by pressure. This head

is large, the bones weighty, and its whole appearance massive and indicative of a large bony frame.—Measured from the junction of the ossa nasi with the os frontis to the posterior edge of the foramen magnum, it gives 14½ inches: the circumference of the cranium immediately above the orbits is 22 inches, so that in these dimensions, it is scarcely less than a common European skull.—The face is very broad and all its parts large. The superciliary ridges are more prominent than common; the orbits large and quadrangular; bones of the nose large, long, and strongly turned to the right; the nasal orifice large; nasal spine sharp and long; alveolar arch large and flattened in front.—Malar bones high and broad.—The forehead is spacious in a lateral direction, and strongly bounded by the temporal ridges. Above the superciliary eminences it is much flattened, and rises in front of the coronal suture; behind this part is a deep circular indentation, resembling that in plate sixth, at one part of which near the vertex is a pit, a quarter of an inch deep. The parietal protuberances are pushed out of their usual situation, that of the right side being thrown outward, so much as to overhang the mastoid process, while the left is pushed inward toward the middle line.—The inferiour occipital region is spacious; foramen magnum of moderate size. The posterior nasal openings and all the foramina large. Palatine

fossa deep yet not extended backward, the horizontal plate of the palatine bones not being broader than in the European. The measure across the base from one zygomatic arch to the other, is 6 inches; which is more than in other heads of any race. The teeth indicate a subject of about 45 years. They are worn to the bony interior.

In my possession is the lower jaw of a savage of the northwest coast, brought here some years since, which corresponds in its dimensions with this cranium. It is of great size, but its main peculiarity lies in the teeth; 14 are in their places and without blemish, yet all worn into the bony substance. The dentes sapientiæ have disappeared, and their alveoli are so perfectly obliterated, as not to leave a trace of their having existed—a fact showing the great age of the subject. This jaw was taken from a native, a man above 80 years old, who had formed a conspiracy to seize an American ship on the coast; his band, being on board for the purposes of trade, suddenly attacked the crew, the master of the ship was killed by this savage, who was himself slain, his party overpowered by the crew, and his jaw brought home as a trophy.

All the appearances in the distorted parts of this head tend to prove that pressure had been applied at an early period of life.

An examination of these heads has led me to a comparison with those of the aborigines of our own country; at least such as I could obtain; but as the natives of these districts have been long since extinct; and their mode of depositing the bodies in the earth without a covering, exposed them to speedy decomposition, it is not easy to have their bones in a perfect state.—Of three in my possession, one was some years since discovered in digging the foundations of a house at West Boston; another was found at the peninsula of Nahant, fifteen miles from Boston, amidst a group of Indian skeletons, buried, as was their custom, in a sitting posture on a pleasant eminence. It had undoubtedly lain there many centuries. Both of these skulls exhibit the character of the American race; the high and spreading cheek bones, large quadrangular orbits, wide nasal aperture and flattened alveolar ridge. They differ from the Columbia skull, plate sixth, in the greater development of the cranium, and flatness of the face. The superiour maxillary bone in the Nahant skull projects little more than in the European: the forehead is slanting yet broad, and rises gently to the vertex, which is quite elevated. This cranium is ample across the parietal protuberances, and the measure from the root of the ossa nasi to the posterior edge of the foramen magnum equals that in the European. This foramen and the others in the base of the cranium

are not large; the palatine fossa is of small extent, in which it differs from the West Boston head. The space between the orbits is wide: and all the characters of this cranium except the slanting forehead, those of what has been called an intellectual head.—In a third head procured for me by Dr. Parkman, from the heirs of the late Dr. Bentley, of Salem, said to have belonged to an Indian sachem, the malar bones are elevated and spread as in the American; but the forehead is narrow like the African: the region of the vertex is however more developed than in the latter.

Being informed of an Indian cranium from the Ohio in the collection of the Boston Linnean Society, I obtained leave to examine it, with the intention of comparing the appearances in the Southern Indian with those of the nations who possessed the country we now occupy.—On the first view of this head, I was disposed to believe there had been a mistake regarding it; as the forehead was quite elevated, the orbits small, the whole apparatus of processes slightly marked, and the appearance smooth, like that of a young female of European origin. The inscription accompanying it was this: "This skull of a human being, and bowl," (accompanying it) "were found sixty miles below Marietta, in the state of Ohio, in a cavity of the rocky bank, fifty feet high from the river, in a place never wet by the rains nor the dampness of the atmos-

phere. The skeleton was perfect, although from the length of time it had lain there, the bones had separated from each other. The bowl, which is made of marine shells and burnt in straw, was placed at the head of the body. It is supposed this person was one of the original inhabitants who erected the ancient works at Marietta." On further examination of this head I was satisfied that it was not that of a European, nor of a North American Indian; nor does it in truth possess the characters of any race now known and described. The body had lain on the right side, whence the right side of the cranium was discoloured and decayed; the left was firm, clear, and white, and two of the molar teeth preserved on this side, with a beautiful white, unworn enamel; the dentes sapientiæ had been developed, and some of the sutures were slightly co-ossified. It was of course the head of a perfect adult. The forehead is remarkable for being more nearly vertical, from the superciliary edge of the orbit to the frontal protuberances, than in any head of Caucasian origin, out of at least *forty* in my possession; yet as a contrast to this, the upper jaw has a decided projection like that of the aboriginal American, so that a line in the direction of the forehead would cut off the face. The superciliary ridges hardly exist, the orbits are small, sharply defined, and differ from the Caucasian in being more open laterally; the space between them

is not contracted; the nasal bones being wider than in the American race. The malar bones project in front but not at the sides. The nasal opening is wide inferiorly. The palatine fossa large proportioned to the size of the head. Viewed according to the *norma verticalis* of BLUMENBACH, the frontal bone is somewhat compressed, and the temporal ridges sharp above the external orbitar process. The frontal bone is long, the parietal small, and swelling at the protuberances. The foramina are generally small. The most remarkable part of this head is its small size. In this respect it is beyond a comparison inferiour to any female European cranium, and its measurements are less even than of a very small female African head: from the last it differs greatly in the form, which is quite globular, while that of the African is oblong.

The secluded and dry situation in which these bones had lain; the protection received from a covering of calcareous rock; the great length of time bones thus situated remain entire; and the peculiarities in the form of this cranium lead us to believe it had lain there many ages and belonged to a nation now extinct.

Whether to refer it to the Chichimecs, or Aztecs who established themselves in Mexico in the twelfth century; to the polished Toltecas, who, coming from the north, appeared in Mexico twelve hundred years ago; or to go farther back to

Hiongnoux from Asia, or to people who, in the the earlier ages of the world, inhabited this quarter of the globe, are curious and interesting questions, but not to be answered at present. Humboldt,* while he has made many distinctions, in regard to the American nations, has one remark, to which he seems to make no exceptions. "There is no race on the globe," he says, "in which the frontal bone is more depressed at its back part or in which the forehead is less elevated," than in the American. All the South American nations, therefore, we are to conclude, have the forehead flat, or retreating; and to their ancestors we are not authorized on this ground to refer the cranium discovered on the Ohio. That it was the head of a female seems probable from its delicacy and on the slightness of its processes, that she was a person of consequence, may be supposed from the pains taken to place the body in a situation almost inaccessible, and that she belonged to a nation of great antiquity appears from the form of the cranium as well as other circumstances.†

**Essai politique sur le Royaume de la Nouvelle Espagne. Tom.* 1. p. 397.

† All who have turned their attention to the subject have, I believe, satisfied themselves that the ancient inhabitants of the Ohio and the Mississippi, of the middle and southern part of the United States, were a different people from the aborigines found here by our ancestors. The enormous fortifications, and other works on the banks of these great rivers and of

The heads of the North American Indians we have examined, are peculiar on the whole for

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the Missouri were raised by people of different habits from the North American Indians; for in the bitterest wars of the latter with each other or with the whites, they never raised, for their defence, any thing more than a picket or palisade, guarded by bushes, trees, and swamps. Such are the works described by LEWIS and CLARK, in their western expedition; and such were raised in New England in the wars which happened soon after the settlement of this country by Europeans.

The works on the Ohio have been very satisfactorily described and represented by C. ATWATER, Esq. in a paper published in the first volume of the *Archæologia Americana*. This writer informs us that the skeletons found in those works did not belong to a people like our Indians. They are short and thick, rarely over five feet high, and few indeed above six. —The works are found on all the great rivers east of the Rocky Mountains, and may be traced south into Mexico; and bear a strong resemblance to the earthy mounds found by the Spaniards on their arrival in the Mexican empire.

Among the articles dug up on the banks of the Ohio, there are many showing that those who manufactured them were much more advanced in the arts than the American Indians of our time. There is a curious vessel in the form of a small goblet, placed in the midst of three human heads. These are extremely well wrought and have, as is said, all the marks of the Tartar countenance. The figures in the paper already mentioned certainly resemble the representations of the ancient inhabitants of Mexico. So that this vessel, so far as a single object can do, serves to connect together the inhabitants of these fortifications with a Tartar race on one side, and with the Mexican nations on the other.

the great projection of the zygomatic arches; the breadth of the face over the malar bones; for the

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The Rev. Mr. HECKEWELDER has given a very authentic and satisfactory account of the North American Indians.* —He proves that all the nations, inhabiting the country of the United States, originated from two stocks, the Lenni Lenape, or Delawares, and the Mengwe or Iroquois. It appears by a tradition of the Lenape, that they resided many hundred years ago in a distant country in the western part of the American continent. From this country they determined to migrate to the east, and after many years' journey, as they occasionally remained a long time in one place, they at length reached the banks of the Namœsi Sipee, (Mississippi) where they met the Mengwe, who had also emigrated from a distant country, and were like themselves in search of new territories.

The Lenape, finding that the country on the eastern side of the river was inhabited by a most numerous people, called Alligewi, collected in large towns, sent to them for permission to settle in some part of their country. This was refused by the Alligewi, but they gave leave to pass through their country further to the east. The Lenape, in consequence of this permission, began to cross the river; but when the Alligewi found them very numerous they were alarmed, attacked and destroyed great numbers of them, and were near compelling them to abandon their expedition. The Mengwe now offered to unite with them; the two nations together made a desperate attack on the Alligewi, and notwithstanding their numbers, and their strong fortifications, the latter after a long war were so much discouraged as to abandon their country and retire along the rivers to the south, whence they never returned.

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* Transactions of the Historical and Literary Committee of the American Philosophical Society. Vol. i. p. 28.

large quadrangular orbit, retreating forehead, and the length, breadth, and depth of the palatine

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The Lenape and the Mengwe divided the country between them. The latter settled near the great lakes, and gave origin to the Six Nations, the Osages, and others. The Lenape spread themselves more extensively, for they gradually occupied the whole eastern or sea-coast country, as well as the interior on the great rivers. From them descended the Indians found by our ancestors, on the discovery of the country: all of whom acknowledged the Lenape for their common father.

This tradition has been carefully collected by Mr. HECKEWELDER, during a long residence among the Lenape or Delawares. It is so consistent with itself, accords so well with existing appearances, and is so strongly supported by affinity of language, that there can be no doubt of its being a genuine history. But although it explains the disappearance of the Alligewi, and the settlement of this country by new nations, it does not pretend to inform us whence originally sprung the Alligewi, or their conquerors. Probably the former passed over from Asia at a period long before the other; and from their knowledge of the arts, it is to be presumed they came, by some means or other, from a more southern part of Asia than the Lenape. The latter, no doubt, crossed the narrow strait between Asia and America, extended along the western coast, until their population became numerous, and were then compelled to move toward the east in search of an easier subsistence.

We may expect from these facts to find a difference in the osseous fabrick of the ancient inhabitants of this country and the Indians still existing; but in what particulars they differ must be determined by future observations.

fossa. To these most distinguishing characters may be added the large size of the nasal openings, anterior and posterior; smallness of the bones of the nose; projection and flatness of the alveoli of the upper jaw; the depth of the temporal fossa and vertical length of the external auditory foramen.

The head of the South Sea Islander, Plate eighth, was brought from Dominica, called by sailors Dominque, to distinguish it from an island of the former name in the West Indies. This is the largest of the Marquesas, in the Pacific ocean. The inhabitants of these, together with the neighbouring group of Washington islands, we have already spoken of as a well formed people, approaching in some respects the Caucasian race. This head resembles the African in the general shape of the face, the European in the capacity of the cranium. On a front view the forehead appears narrow, and slanting; the orbits large and near together; ossa nasi small; orifice of the nostrils large and long; malar bones high, but not spread like the American; the os maxillare superius is long, and its alveolar edge prominent, as in the African; the lower jaw is broad, its alveolar edge projects, and the chin retreats moderately; so as to produce a prominence of the mouth greater than in the American or European, less than in the African. Seen in the norma verticalis, the fore part of the

cranium is compressed like the African; the zygomatic arches project more than in the African, less than in the American. The vertex extends horizontally backward, and presents a considerable surface between the parietal protuberances. The orifices in the base of the cranium are large. Measured from the root of the nose to the foramen magnum, and around the head horizontally, its dimensions equal those of a common European. The meatus auditorius externus and its vaginal process are very large and open, in this head. The same parts in all the American heads are flattened from before backward, so as to give them a vertically oblong form; which is observable also in African heads, while in the Caucasian, this orifice has a more circular appearance. Viewed as a whole this head is remarkable for its symmetry, its size, the extent, and regularity of the masticating apparatus, and the ivory texture of the bone. It combines the characters of the European and African, partakes but little of the American or Mongol. The skull was purchased by the master of an American vessel from a native, who wore it as the spoil of an enemy. Captain PORTER, in his journal, speaks of the practice of suspending enemies' skulls at the waist, or in the habitations of the natives.

Explanation of the Plates.

The object of these plates is to represent the nervous system in the invertebral animals; one animal has been selected from each class, with the exception of the zoophytes, which are destitute of nerves. They are from dissections made for this purpose.

The nervous system of the acephalous mollusca has been represented in preference to that of the cephalopode, on account of its peculiarity, and the wider difference of its character from the vertebral, and from the other invertebral systems.

The crustaceous system was placed first in order, and more minutely described, because it is well fitted to give a general notion of the knotted nerve and the rest of the nervous system in invertebral animals. The worms are represented by the leech, and the insects by the centipede.

These drawings were made by Dr. Flagg, to whose kindness and skill I am under great obligations.

PLATE I.

CANCER GAMMARUS. *Common Lobster.*

The shell is removed from the back, or upper part of the body; the branchiæ or gills are taken away; the tail, or part with which the animal swims, is cut off, on account of its occupying too much space; the claws divided near the body. This is of course the anterior part and includes the head.

Anteriorly are seen the two great antennæ, between which lie the two small antennæ, bifurcated at the extremities so as to appear like four. Between the small antennæ is the proboscis, projecting from the fore part of the head. On the sides are the sections of the two large and eight small claws.

a. The stomach turned on one side, in order to show the nerves about the esophagus: the latter is embraced by these nerves, the mouth, being on the inferiour face, is not seen.

b. Part of the alimentary canal.

c. c. Muscles which move the mandibles.

d. d. Portions of the muscles which move the claws.

e. Cavity, giving lodgment to part of the muscles of the eye.

f. The brain, of a rounded form, very distinctly shown.

g. Optic nerves, issuing from the fore part of the brain. That of the right side disappears on penetrating the tubercle of the eye. On the left side, the tubercle is open, the nerve is seen within its cavity; first enlarging into a nervous mass, afterwards dividing into a pencil of nerves, which are lost in the choroid coat, through which they penetrate to the cornea.

h. Nerves of the great antennæ. From the same place branches are distributed to the membranous lining of the shell, posterior part of the stomach and muscles moving the mandibles.

i. Auditory nerves. They are seen entering the cavities of the ears and dividing on the pulpy membrane of the organ.

k. The two principal nerves from the brain, passing backward to form the *collar*. As they approach the esophagus, they gradually separate and pass on each side so as to embrace it; behind they approach and re-unite, thus forming the *collar*, which extends from *k.* to *l.* Branches pass upward from the collar on the stomach, downward to the esophagus and neighbouring parts.

l. l. Nerves, going forward from the first ganglion to form a plexus with those from the collar, whence nerves are furnished to the articulation of the mandibles and muscles.

m. Five ganglia, from each of which a nerve is sent on each side to supply the claws, and also the muscles and viscera of the body. The lon-

gitudinal nerve which forms these ganglia is continued into the tail, where it forms six more ganglia, not here included. The ganglia have given to the principal nerve of invertebral animals, the name *knotted nerve.* This consists in reality of the two nerves of the collar, lying so near each other, as to appear but one—and in this way we have represented them. When examined by the microscope, the cord, between each of the ganglia, is seen to be composed of two longitudinal nerves.

PLATE II.

Ostrea Edulis. *Oyster.*

In the acephalous mollusca, to which this animal belongs, the nervous system is not so distinct nor symmetrical as in many invertebral animals.

a. a. The internal surface of the shell.

b. b. One portion of the mantle which covers the animal like a skin, exhibited on the shell.

c. c. The other half of the mantle raised and folded aside, to bring into view the parts beneath.

d. d. The branchiæ extending nearly to *a.*

e. The brain.

f. f. The principal nerve, sending branches as it passes to the branchiæ.

g. A considerable enlargement of the nerve.

h. Blood vessels.

i. Probe passed into the esophagus.

k. Muscle attached to the shell.

PLATE III.

HIRUDO MEDICINALIS. *Medicinal Leech.*

1. Two small nerves surrounding the mouth and going to the disk. They come from the first ganglion.

2. Minute nerves to the mouth.

a. The three piercers or teeth.

b. A large ganglion, from which issue nerves, surrounding the esophagus and forming the *collar.* We notice on each side of it a nervous mass, *c. c.*, constituted by a collection of nerves which form a sort of plexus. From this proceed many nerves *d. d.*, seen running almost the whole length of the body. They are distributed to the cuticle, cutis, and muscular coat, by which the leech performs its motions. From the posterior part of the large ganglion proceeds a short nerve to the ganglion next. This lies very near to the former.

e. e. Longitudinal cord composed of two nerves, running the whole length of the body. At the distance of, from one to two lines, the ganglia are seen. They are twenty-two or twenty-three in number. On each side of a ganglion two nerves are sent, principally to the stomachs; so that each ganglion sends out four nerves.

f. f. Abdominal blood vessel. This encloses the longitudinal nerve and ganglia; or else is enclosed in a common sheath with them. The vessel has been removed from the anterior part of the nerve above the first; also from the middle part of the nerve, near the generative organs, and at the posterior part, the vessel is seen covering the nerve.

g. g. The two lateral blood vessels. Besides these and the abdominal, there is one other blood vessel called dorsal; thus making four in all.

h. h. Lateral vesicles. They are about thirty in number. They do not communicate with each other; but open on the surface of the skin; whence they are supposed by some to be the organs of respiration; while others consider them as mucous bags, destined to pour out a mucous substance on the surface of the body.

i. i. Generative organs. At the first *i*, is seen the penis and testes, at the other, the uterus, as it appeared on various dissections.

k. k. Vasa efferentia.

l. l. Abdominal vesicles. These communicate by the vasa efferentia. They contain a fluid similar to that of the testes, which they are thought to receive from the vasa efferentia.

Behind the other parts, from *k. k.* to the posterior termination of the animal are seen the stomachs, occupying a principal part of the body. They are twenty-four in number, twelve on each side. They communicate with each other, with the esophagus anteriorly, and with the anus posteriorly. The last is situated on the upper part of the animal.

PLATE IV.

SCOLOPENDRA MORSITANS. *Centipede.*

At the fore part is seen the head, laid open on its under surface, as well as the body.

In front of the head are the two antennæ, at the roots of which are two of the eyes. Behind these appears the brain, sending, anteriorly the two optic nerves to the eyes, and posteriorly the two nerves which form the collar. On each side of these is a nerve sent downward to the jaws.

The nerves which form the collar, having reunited, form a series of ganglia equal in number to the rings and pairs of legs. From each ganglion, three pairs of nerves, two more conspicuous than the third, supply the legs, muscles moving the rings, and neighbouring viscera.

In this specimen are twenty-one ganglia, the last a very small one.

LIST OF AUTHORS OF THE ANNUAL DISSERTATIONS, THEIR SUBJECTS, AND THE YEARS IN WHICH THEY WERE DELIVERED.

John Brooks, M.D. On Pneumonia - 1808

Abraham Haskell, M. D. On Cynanche Trachealis, or Croup - - - - 1812

Oliver Prescott, M. D. On the Natural History and Medicinal Effects of the Secale Cornutum, or Ergot - - - - - - 1813

Richard Hazeltine, M. D. On Phlegmasia Dolens 1816

Hector Orr, M. D. On the Properties of Animal and Vegetable Life - - - - 1817

James Jackson, M. D. On Fever - - 1818

John C. Warren, M. D. On the Sensorial and Nervous Systems in Man and Animals - - 1820

Nathaniel Bradstreet, M. D. On the Proximate Cause of Fever - - - - 1821

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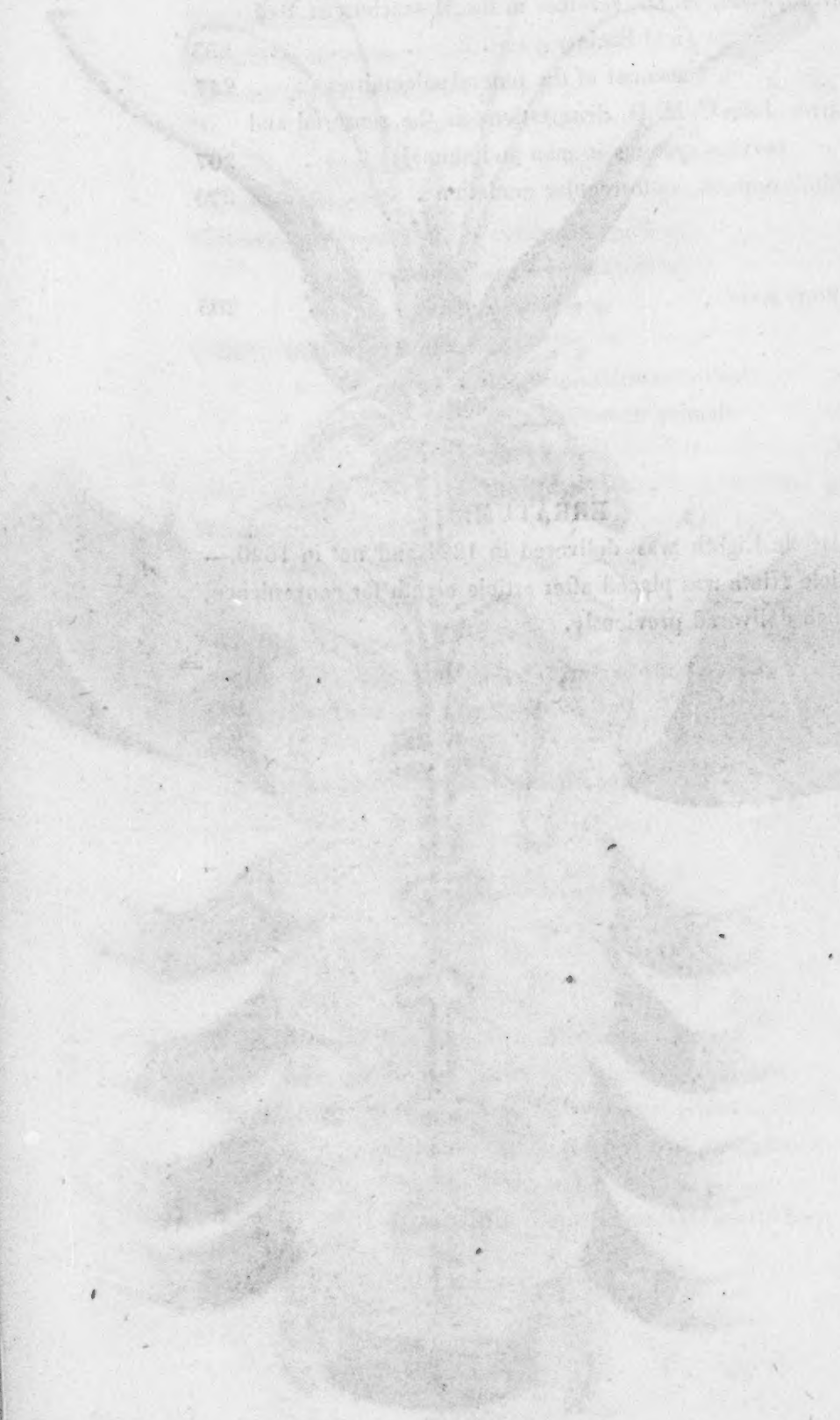
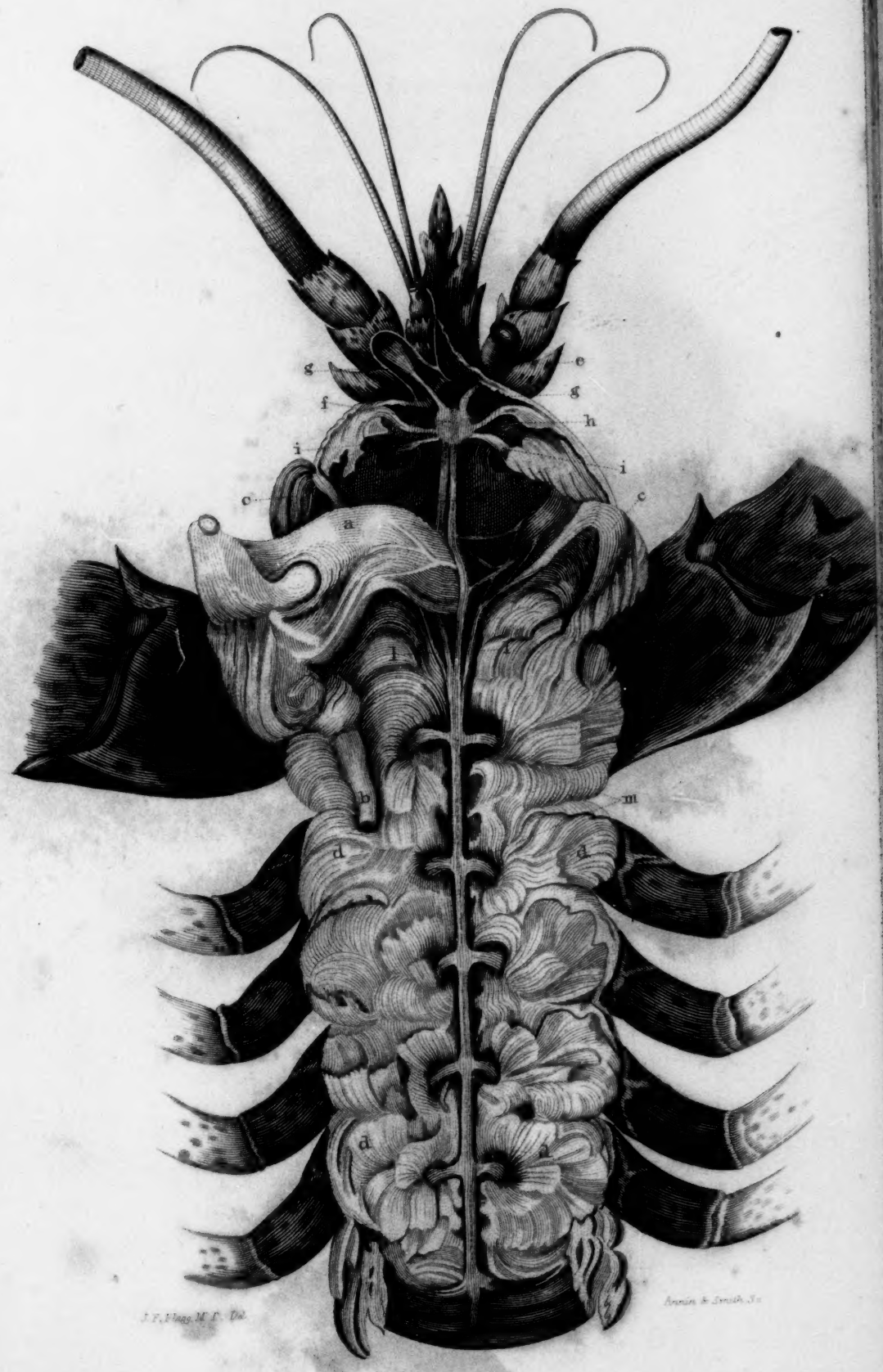
ERRATUM.

Article Eighth was delivered in 1821 and not in 1820.—Article Ninth was placed after article eighth for convenience, though delivered previously.

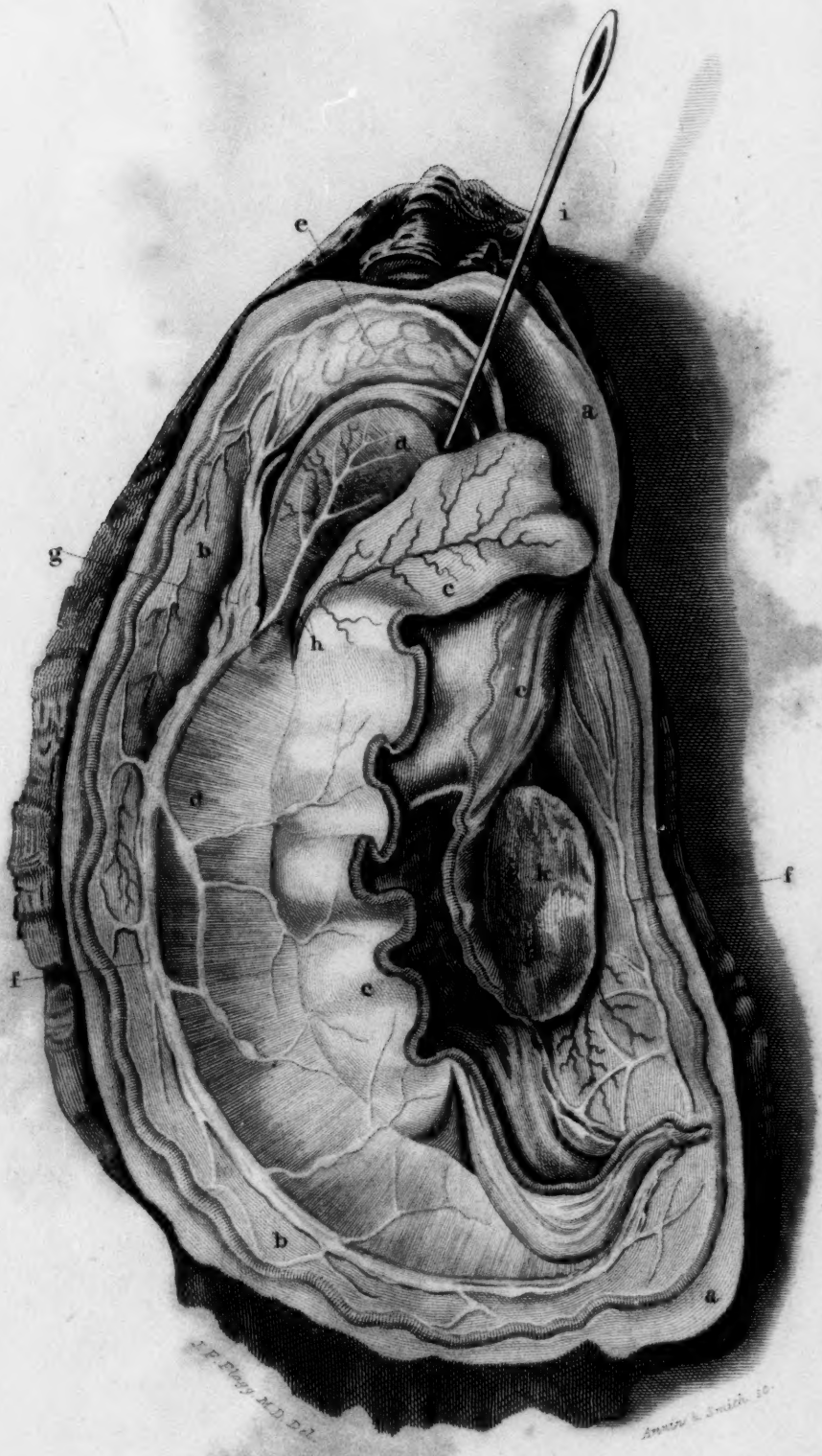


Pl. I



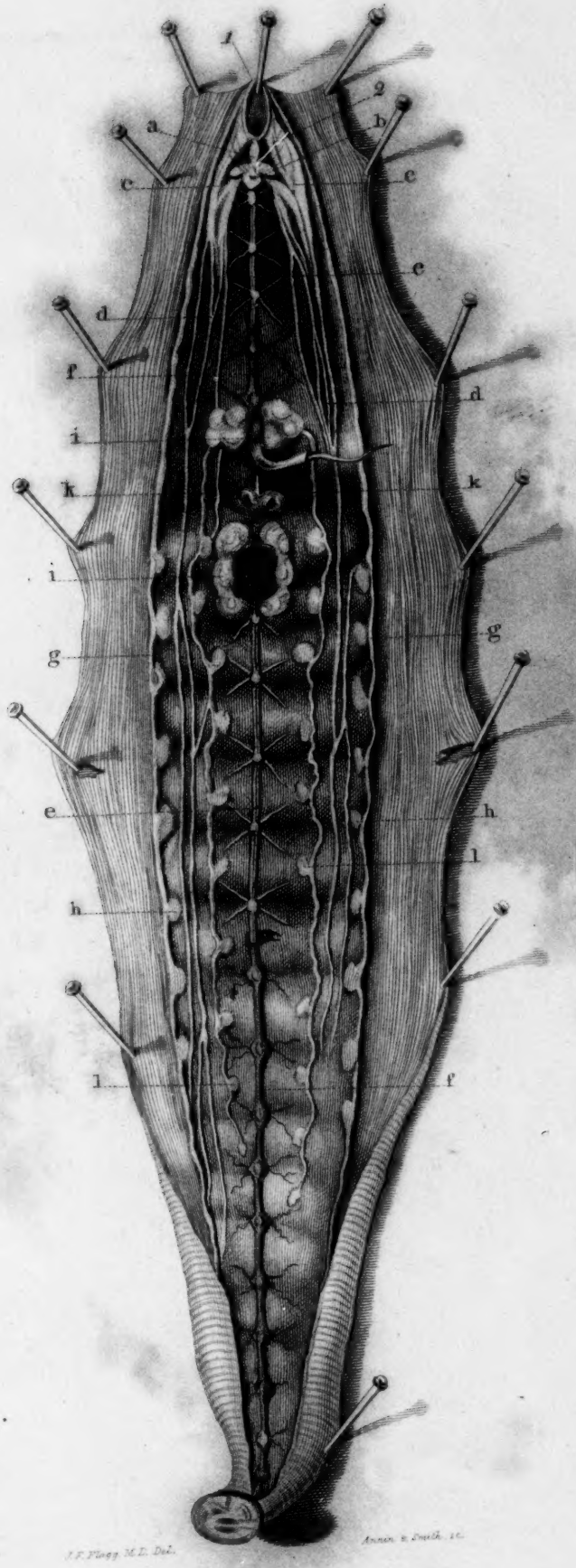
Cancer Gammarus

Pl. II



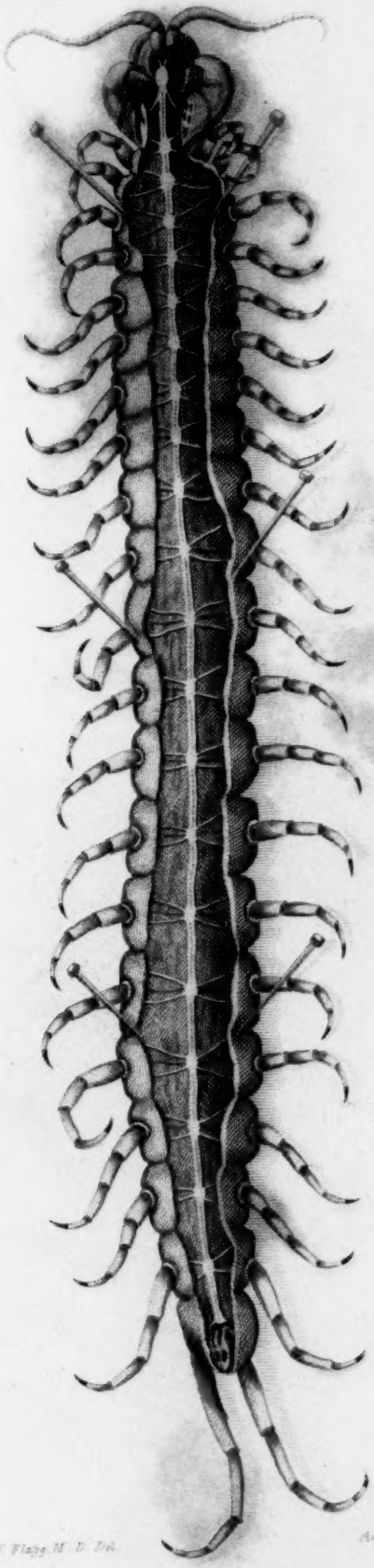
Ostrea edulis

Pl. III



Hirudo medicinalis.

Pl. IV



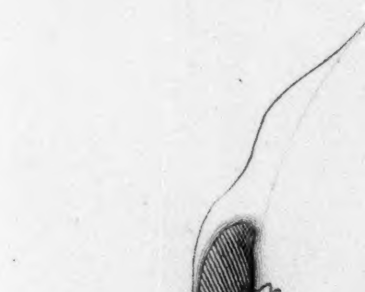
J. E. Flagg M. D. Del. Annin & Smith Sc.

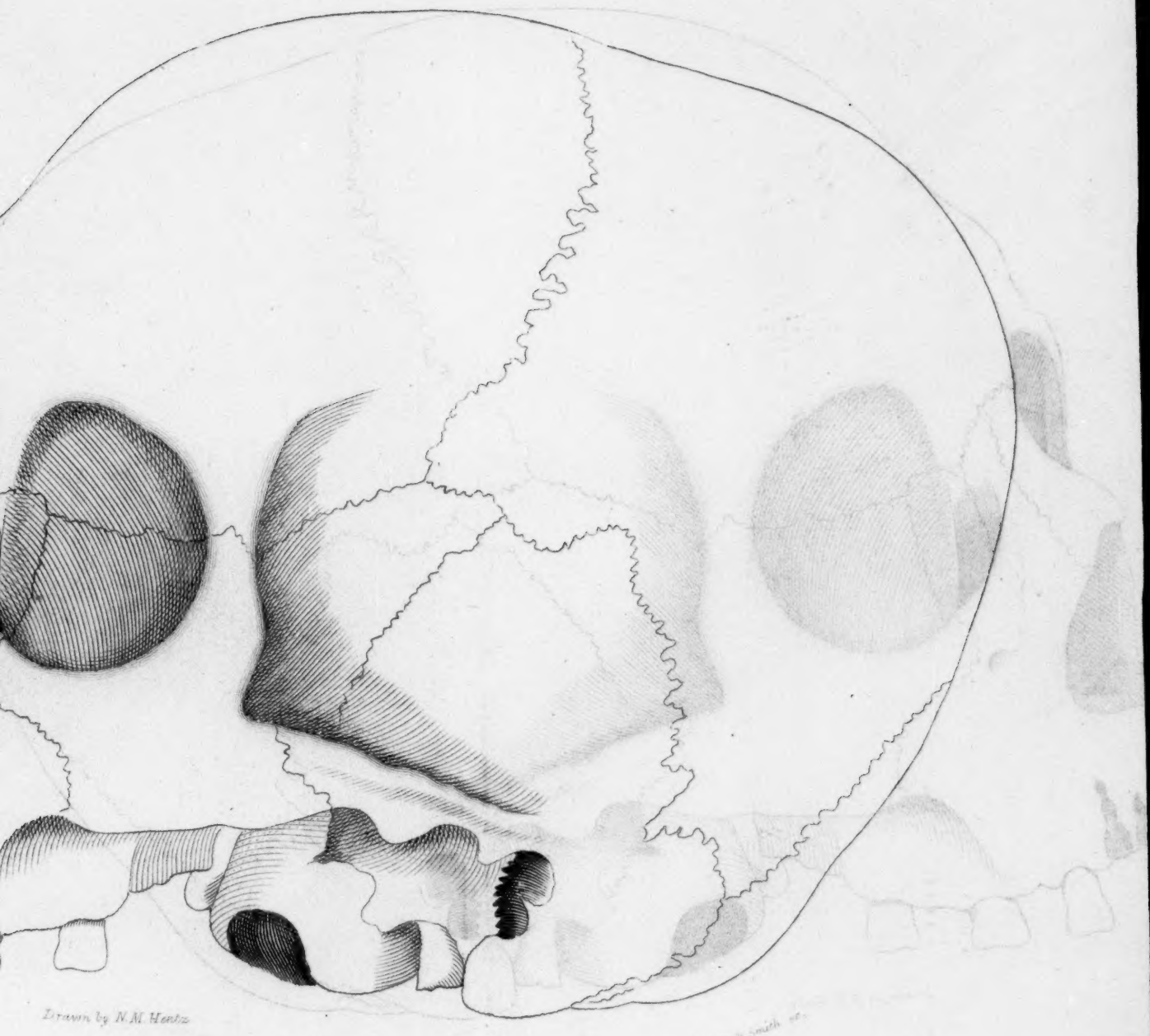
Scolopendra morsitans

1

Caucasian head

Pl. VI





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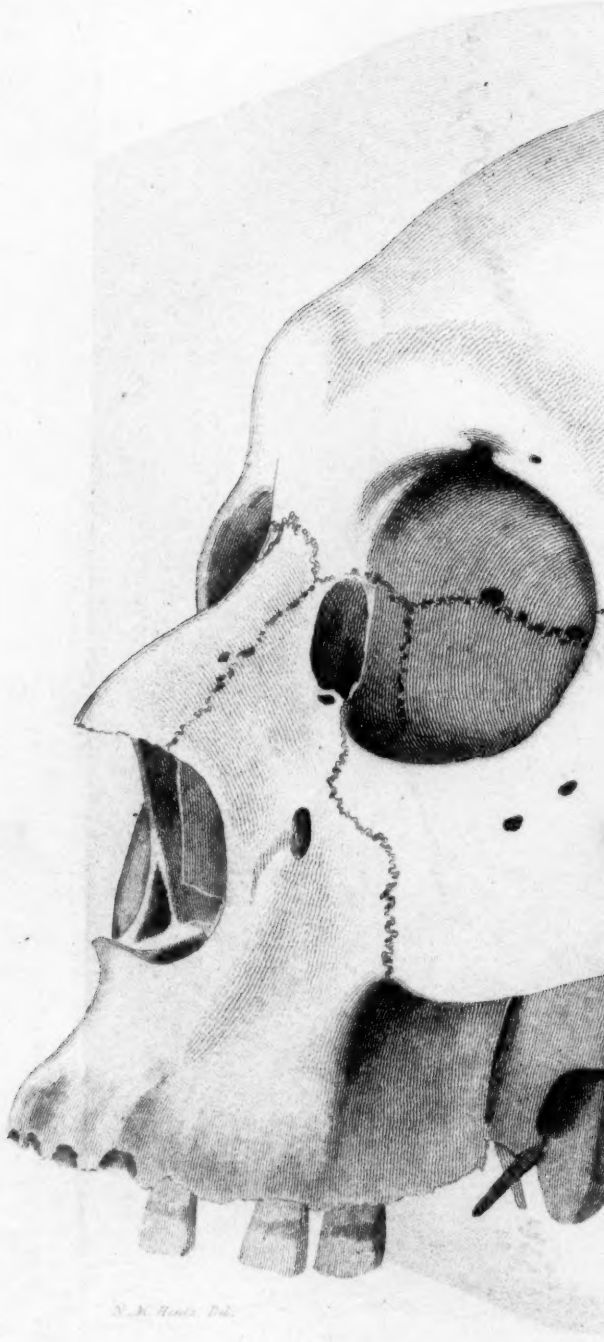
American of Columbia river

PL. VII



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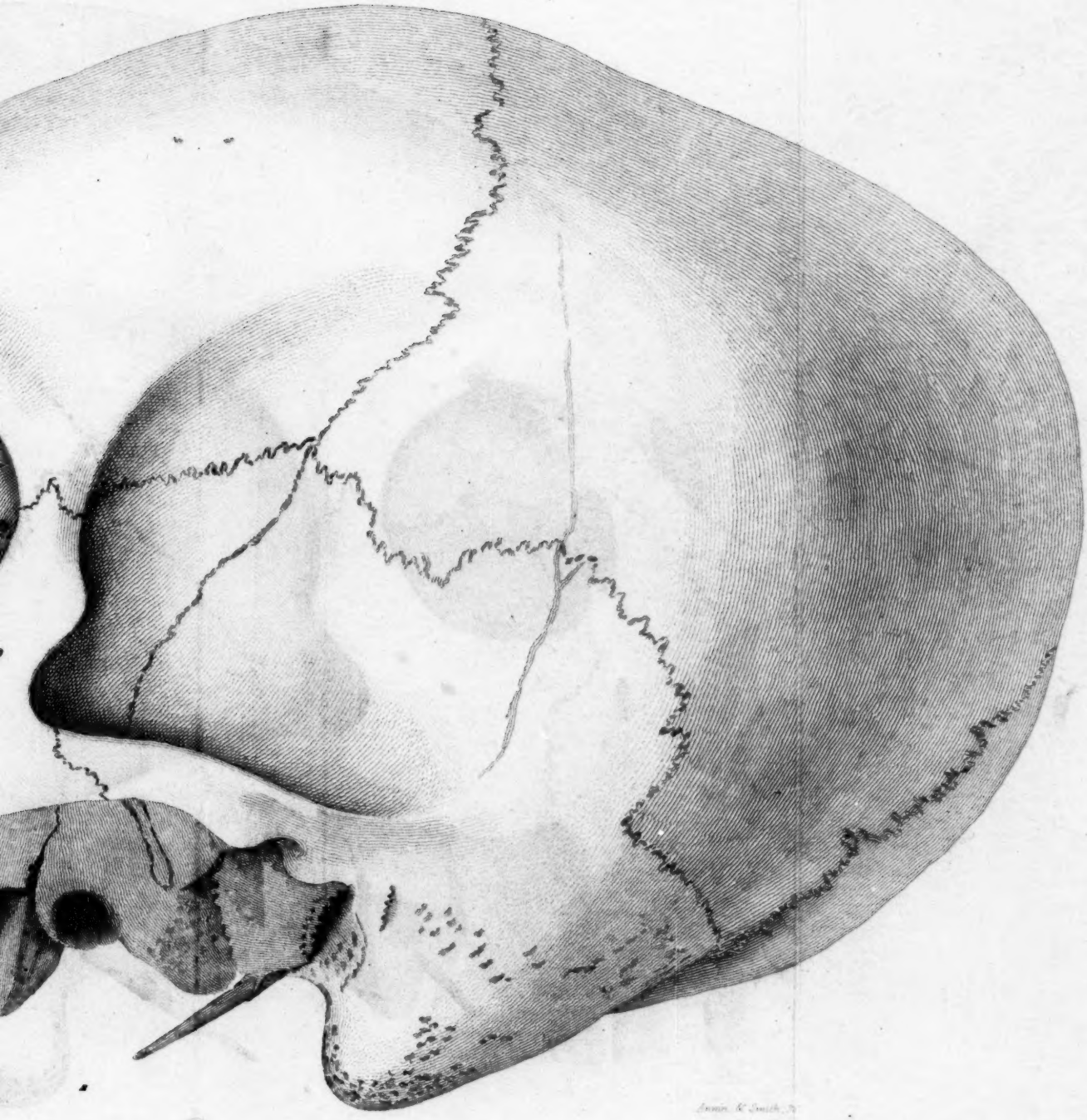
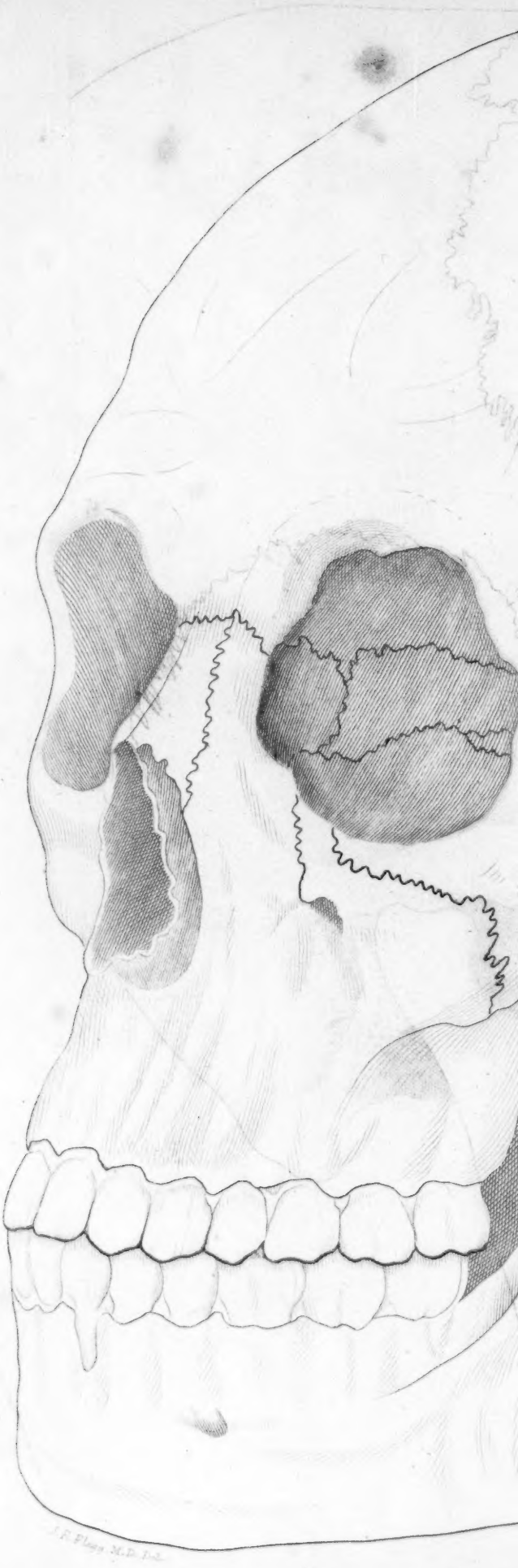
American Flatheads of Columbia river.